WRITING JUSTICE IN THE SCHOOL SYSTEM: AN INTEGRATIVE REVIEW OF HANDWRITING USING THE FRAMEWORK OF OCCUPATIONAL JUSTICE

by

Alanna Fay Ferguson

Submitted in partial fulfillment of the requirements
for the degree of Master of Science

at

Dalhousie University
Halifax, Nova Scotia
March 2011

DALHOUSIE UNIVERSITY

SCHOOL OF OCCUPATIONAL THERAPY

The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "WRITING JUSTICE IN THE SCHOOL SYSTEM: AN INTEGRATIVE REVIEW OF HANDWRITING USING THE FRAMEWORK OF OCCUPATIONAL JUSTICE" by Alanna Fay Ferguson in partial fulfilment of the requirements for the degree of Master of Science.

Dated: 2011 March 11

Supervisor: _____

Readers: _____

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DALHOUSIE UNIVERSITY

DATE: 2011 March 11

AUTHOR: Alanna Fay Ferguson

TITLE: WRITING JUSTICE IN THE SCHOOL SYSTEM: AN INTEGRATIVE REVIEW OF HANDWRITING USING THE FRAMEWORK OF OCCUPATIONAL JUSTICE

DEPARTMENT OR SCHOOL: School of Occupational Therapy

DEGREE: MSc CONVOCATION: May YEAR: 2011

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Signature of Author

DEDICATION PAGE

For my parents, Deanna and Willie-
Thank-you for instilling in me since I was a little girl,
the belief that with a "bit" of hard work
I can do anything I put my mind to.
& Thank-you for gifting me the extraordinary
genetics of being able to function with very little sleep!
I am forever grateful and proud you are my parents.

For my husband, Alex-
Every moment of this journey, through the times of celebration and
self-doubt, and through all the tears that were shed,
you always held an unwavering belief in me.
You have taught me so much about unconditional love, Thank-you.
You inspire me to be a better wife, friend
and Occupational Therapist!

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ABSTRACT

Handwriting is a complex occupation; it is an intricately coordinated symphony of skills and interactions. The success of a child's handwriting is dependent on many factors and conditions. The concept of occupational justice implies, as a determinant of health and well-being, all children have the right to access sound handwriting instruction and if required, supportive services for therapeutic intervention. However, a number of school-aged children do not have access to sound handwriting instruction or therapeutic intervention. This is an occupational injustice. An integrative review of the occupational therapy literature was completed for the purposes of enhancing the understanding of handwriting in the school system. The Revised Framework of Occupational Justice was used to guide the analysis of the literature sources and identify the conditions contributing to an occupational injustice. The results of this review provided a comprehensive overview of handwriting and identified conditions leading to an occupational injustice in handwriting.

LIST OF ABBREVIATIONS USED

ADD	Attention Deficit Disorder
ADHD	Attention Deficit Hyperactivity Disorder
AJOT	American Journal of Occupational Therapy
AOD	Alternate Output Device
BOTMP	Bruininks-Oseretsky Test of Motor Proficiency
CAOT	Canadian Association of Occupational Therapists
CIHI	Canadian Institute for Health Information
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CJOT	Canadian Journal of Occupational Therapists
CMOP	Canadian Model of Occupational Performance
CMOP-E	Canadian Model of Occupational Performance and Engagement
CO-OP	Cognitive Orientation to daily Occupational Performance
CP	Cerebral Palsy
CPS	Colorado Perceptual Speed Test
CFS	Consultation Summary Form
DCD	Developmental Coordination Disorder
DTVP-2	Developmental Test of Visual Perception
ERGS	Error Recognition and Grading Scale
ERIC	Educational Resources Information Center
ETCH-C	Evaluation Tool of Children's Handwriting-Cursive
ETCH-M	Evaluation Tool of Children's Handwriting-Manuscript
GTI	Graphomotor Task Instrument
HES	Handwriting Evaluation Scale
HPT	Handwriting Performance Test
HST	Handwriting Speed Test
HW	Handwriting
HWT	Handwriting Without Tears®

ICC	Intraclass correlation
ICF	International Classification of Functioning, Disability and Health
IP joint	Interphalangeal joint
K	Kindergarten
LD	Learning Disability
LHP	Log Handwriting Program
MAC	Motor Accuracy Test
M.A.T.C.H.	Modify the task, Alter your expectations, Teach strategies, Change the environment, Help by understanding
MHA	Minnesota Handwriting Assessment
MHT	Minnesota Handwriting Test aka Minnesota Handwriting Assessment
MVPT	Motor-Free Visual Perception Test
OPP	Occupational Performance Process
OT	Occupational Therapy
PEO	Person, Environment, Occupation Model
PICO	Problem or patient, Intervention, Comparison, Outcomes
PQ	Publication Questionnaire
RCT	Randomized Controlled Trials
SCRIPT	Scale of Children's Readiness In PrinTing
SCSIT of Kinesthesia	Southern California Sensory Integration Test of Kinesthesia
SCSIT of FI	Southern California Sensory Integration Test of Finger Identification
SFA	School Function Assessment
SRS	Speech Recognition Software
THS	Test of Handwriting Skills
TMP	Test of Manual Pointing
TOLH	Test of Legible Handwriting
TOWL	Test of Written Language
TOW-P	Tool For Optimizing Written Productivity

TROM	Torque Range of Motion
TVPS	Test of Visual-Perceptual Skills-Non Motor
URDC	Utility, Relevance, Design, Content
VABS-C	Vineland Adaptive Behavior Scales-Class Room Edition
VMI	Developmental Test of Visual-Motor Integration
WCP	Western Canadian Protocol
WFOT	World Federation of Occupational Therapists
WHO	World Health Organization
WNCP	Western and Northern Canadian Protocol

ACKNOWLEDGEMENTS

"I long to accomplish a great and noble task, but it is my chief duty to accomplish small tasks as if they were great and noble."- Helen Keller

My thesis journey hasn't been without the emotional rollercoaster or the substantial potholes in the road, as I am sure, is a familiar situation for most individuals engaging in a similar adventure. Analogous to raising a child, it has taken a community of individuals that I respect dearly, to nurture my graduate endeavors and thesis completion. My words will likely never express the enormity of gratitude I have for those individuals in my life that believed in me and provided me with the tools to pursue my inquiry.

Dr. Joan Versnel and Dr. Grace Warner, thank-you a million times over for supporting me through this ambitious journey. I am grateful to you both for the sacrifices you made to ensure I accomplished each deadline, which was fast approached by the next. I appreciated your knowledgeable insights and your motivational discussions via Skype™ to ensure my thesis was completed with quality and on schedule. I have discovered my strengths and weaknesses as a result of your mentorship. Thank-you. Dr. Elizabeth Townsend, Dr. Ann Wilcock and Dr. Robin Stadnyk, I believe our profession is in debt to you three for providing an eloquent voice for one of occupational therapy's foundational pillars of knowledge: occupational justice. In my pursuit of researching this paradigm as it relates to handwriting, I explored my passion for the occupation and our professional ability to advocate for an individual's opportunity to participate in health-building, meaningful occupations. Thank-you.

There is a very special place in my heart for my colleagues within the Alberta Children's Hospital, Regional School Health Program. My thesis was inspired by our role in the classroom and our daily discussions of how we can enhance our practice to support our children and teachers further. I have learnt so much about occupational therapy from each one of you. I am overwhelmed by the caliber of knowledge in our program. You inspired me every day through your practice. You have been mentors to me in my professional and

personal life. You have embraced my vivacious spirit, inquisitive nature, unconventional, almost-obsessive organizational abilities and my effervescent cheerleading of my dream for "*Letter Formations For The Nation"!* In your acceptance, you have taught me that it is okay to be me. Thank-you. I will forever cherish my memories.

I'd also like to acknowledge my mentors within the Alberta Children's Hospital, particularly Gwen Roberts, Lori Craig and Brenda Wilson. I can say with absolute certainty that my career has been shaped by the influences of you three. You inspired and enabled me to pursue all my research interests by never saying No, but *How*. You encouraged my application to graduate studies and supported my every idiosyncrasy. You have illustrated to me by example of your own lives, that one may gracefully juggle the roles of super mom, inspirational clinician, and respected mentor. Your enthusiasm and support for my dreams was never-ending. Thank-you.

I am so proud to be able to celebrate this accomplishment with my parents and my sister because without their years of support of my educational pursuits; late night phone conversations, random cards of encouragement, and instinctual text messages during the times I needed them the most, I would not be where I am today. Mum and Dad, you have given me the greatest gift; the proverbial keys to life. Any door I wanted to open, regardless of how much effort it required to unlock the locks or the emotional outcome experienced as a result of the desire, you two have always been there to support me in your own way, which I respect dearly. Thank-you. I am also so proud to celebrate this moment with my husband. You have taken the word *unconditional* and transformed it into your best attribute. Nobody pre-warns a husband that when his wife endeavors into the world of graduate studies, his life and responsibilities, automatically changes. Alex, you have embraced this change with compassion, insight and enthusiasm! Thank-you. I can't wait to enjoy a guiltless weekend of skiing with you!

In closing, I would like to acknowledge all the children, teachers, and schools I have had the pleasure of working in partnership with and learning from over the years. Your experiences with handwriting have inspired my passion to learn more about this occupation and to hopefully, initiate a conversation that advocates for change. Thank-you.

CHAPTER 1 INTRODUCTION

1.1 A MEANINGFUL OCCUPATION

Handwriting is the silent partner in communication. It is the precursor to literacy and the foundation of written interactions. Handwriting provides individuals with a tool. With its interconnections of strokes, lines, and curves scribed onto paper, it may advertise our personalities or reveal our weaknesses. It illustrates our opinions, ideas, and knowledge in manual form. Handwriting is a valuable occupation contributing to our life experiences.

Children, as occupational beings engage in numerous school-based occupations throughout their day. This includes the occupational performances of: play, academic learning, and socializing with peers. All of these school-based occupations affect a student's well being and bring meaning and learning into everyday situations. Handwriting is reported to be a major occupation for children (Cunningham, 1992). Children engage in handwriting for academic and social purposes. The literature indicated elementary school students may spend up to 60% of their daily occupations engaged in fine-motor activities that include paper-pencil tasks (McHale & Cermak, 1992). This reiterates the value and importance of handwriting because children are described to spend a large portion of their day engaged in the occupation.

Handwriting is a meaningful life skill for children. The handwriting habits reinforced through practice in elementary school continue to contribute to a child's engagement in academic and social interactions along their educational journey. As children progress through education they are expected to learn and develop handwriting readiness, form, legibility, and organization. Children are expected to reach a milestone in their development where the mechanics of handwriting become fluent and effortless. This enables a child's focus and concentration to be redirected to the process and skills required for written composition. This reinforces that handwriting is a significant occupation for teachers to teach, and for children to learn within the education system.

There are many children who struggle with this life skill. Handwriting difficulties among school-aged children have been estimated to range from 12% to 44% (Alston, 1985; Graham & Weintraub, 1996; Rubin & Henderson, 1982). When the quality of handwriting is illegible or the quantity of handwriting is limited, the child may experience secondary issues depending on the severity and duration of the handwriting problem. Illegible or limited handwriting may impact: motivation, self-esteem, self-efficacy, achievement, productivity, prejudice a teacher's judgment or bias grading (Case-Smith, 2002; Clark-Wentz, 1997). Because of these secondary outcomes, the acquisition of handwriting is an important occupation in early elementary education (Marr, 2005).

1.2 Occupational Therapy

Teachers refer children with handwriting problems to school-based occupational therapists because of the impact on academic, motoric, or psychosocial performance. Occupational therapists are educated in human anatomy, physiology, mental health, and well-being. They are guided by holistic, client-centered paradigms, and task analysis practice approaches. Occupational therapists are concerned with occupational performance, equitable opportunities for meaningful engagement, and satisfaction in occupations (Townsend & Polatajko, 2007). Carlsson (2009) reported the view of a school-based occupational therapist is, "…beyond impairment, injury, disease or disorder and the focus is on interventions that enables the occupations that are important to the students" (p. 9). Therefore, an occupational therapy referral for a child who demonstrates handwriting problems is an appropriate fit.

Three interconnected pillars uniquely define occupational therapy: Occupation, Client-centered Enablement, and Occupational Justice. Through the progression and development of theories and paradigms guiding occupational therapy practice, history illustrates, occupation is the domain of concern (Polatajko, Townsend & Craik, 2007; Townsend & Wilcock, 2004) that is consistently woven into the architecture and foundation of our profession. In the publication: *Enabling Occupation II: Advancing an Occupational Therapy Vision for Health, Well-being & Justice Through Occupation*, the

basic assumptions of an occupation are captured: "occupation affects health and well-being, occupation organizes time and brings structure to living, occupation brings meaning to life (ascribed by the culture and by the individual) and occupations are idiosyncratic" (Townsend & Polatajko, 2007, p. 21). Opportunities for the engagement and participation in meaningful occupations are a key determinant of health, well-being, life meaning, and social inclusion (Townsend & Wilcock, 2004; Padilla, Gupta & Liotta-Kleinfeld, 2004).

The Charter of Occupational Rights (Townsend, 2003; Townsend & Wilcock, 2004, 2004b) were created to illustrate individuals have occupational rights. An individual has the right: (1) to experience occupation as meaningful and enriching, (2) to develop through participation in occupations for health and social inclusion, (3) right to exert individual or population autonomy through choice in occupations, (4) to benefit from fair privileges for diverse participation in occupations (Townsend, 2003, Townsend & Wilcock 2004, 2004b).

If occupations are woven into the architecture and foundation of occupational therapy, then occupational justice is the blueprint. Occupational justice is a vision to guide the work of an occupational therapist. Occupational justice and occupational injustice are terms credited to Dr. Elizabeth Townsend and Dr. Ann Wilcock (1997). Occupational justice recognizes that humans are occupational beings, who need and want to participate in occupations (Townsend & Wilcock, 2004b; Wilcock & Townsend, 2000). The concept of occupational justice refers to equitable resources and opportunities for diverse meaningful occupational participation that enable an individual to meet his or her potential, experience well-being, and full citizenship (Townsend & Wilcock, 2004). An occupational injustice occurs, "when participation in daily life occupations is: barred, trapped, confined, segregated, restricted, prohibited, undeveloped, disrupted, alienated, imbalanced, exploited, deprived, marginalized, or segregated" (Townsend, 2003 p. 9). Denial of occupational participation jeopardizes the health and well being of all aspects of daily life experienced by individuals, communities and nations (Townsend, 2003; Townsend & Wilcock, 2004b; Wilcock & Townsend, 2000).

The Framework of Occupational Justice has evolved from the concept of occupational justice. It is an exploratory process of justice (Stadnyk, 2007; Stadnyk, Townsend, & Wilcock, 2010; Townsend & Wilcock, 2004; 2004b). Two factors are identified within the framework of occupational justice: (1) Structural Factors: Occupational Determinants and Occupational Forms and (2) Contextual Factors. Structural factors describe the environment, policies or programs, etcetera (Stadnyk, 2007; Townsend & Wilcock, 2004b). Contextual factors are biological, social, or cultural in nature. They describe ability/disability, income/wealth, etcetera (Stadnyk, 2007; Townsend & Wilcock, 2004b). The implementation of this framework allows for a practical and comprehensive overview of the conditions contributing to occupational justice.

1.3 Why This Research?

As a school-based occupational therapist that primarily received referrals for handwriting problems, I have become passionate about the occupation of handwriting. This passion was ignited very early on in my OT career within the schools. I observed the positive and negative impacts of handwriting. When children's handwriting skills are functional, their world of written expression is limitless. However, when children's handwriting skills are immature or delayed, their weaknesses in written expression is reflected as decreased quality and quantity of writing. My interest in investigating handwriting more comprehensively is based on my personal experiences, my passion for the occupation of handwriting, my knowledge of the literature on handwriting, and the Charter of Occupational Rights.

The Charter of Occupational Rights implies that all children have the right to engage in handwriting, access sound instruction, and if appropriate, receive supportive services for therapeutic handwriting intervention. However, my personal experience, supported by the literature, suggests that this may not be occurring.

A recent survey conducted in the United States of America revealed 12% of teachers report their formal undergraduate training for teaching printing was adequate (Graham,

Harris, Mason, Fink-Chorzempa, Moran, & Saddler, 2008). This indicates that 88% of teachers are teaching this skill with inadequate training. Meaning, there are children who are not accessing sound handwriting instruction in the United States. This is a condition potentially leading to an occupational injustice. A Canadian-based survey similar to the one conducted by Graham et al. is not known to exist. Because the United States of America and Canada share like economies and because a similar finding was not identified within the literature, it is assumed that this American finding might also reflect the situation Canadian teachers and students are experiencing.

Additionally, school-based occupational therapy services are limited. The *Workforce Trends of Occupational Therapists in Canada* indicated approximately 5.5% of occupational therapists reported their primary employer to be a school or school board (CIHI, 2007). This indicates that an estimated six hundred and forty-eight registered occupational therapists were working in schools across Canada in 2006. The mathematical calculations illustrating how this number was achieved was presented in Appendix B.

In 2006, there were an estimated twenty nine million children in Canada (Statistics Canada, 2010). As previously mentioned, up to 44% of children are identified to have handwriting problems. Approximately 5.5% of these children may be involved with occupational therapy services. Therefore, according to these statistics, the mathematical calculations suggest approximately twenty eight thousand children with handwriting problems per year may receive school-based occupational therapy (see Appendix B). As a result, not one of the remaining estimated twelve million eight hundred thousand children identified with handwriting problems would have had access to handwriting support from an occupational therapist (Appendix B). It is recognized that this mathematical calculation does not consider the impacts of other handwriting support services available to students. However, from an occupational therapy perspective, this is a condition potentially leading to an occupational injustice.

According to the occupational rights, every child has the right to develop through participation in handwriting, either for health or social inclusion (Townsend 2003, Townsend & Wilcock 2004). Therefore, all of the factors hindering children's participation in handwriting need to be identified to better understand the occupation and the occupational injustice.

In addition, in my role as a school-based occupational therapist, I started to become aware of factors that were negatively impacting the teacher's and my experience with handwriting. For example, from my perspective, the teachers and I were focused on the same problem with different theoretical beliefs influencing our own modus operandi. Teachers were hoping for the magical "fix" which resembled some form of pullout intervention, while I was trying to market enablement through the use of classroom-based, child-specific recommendations, which hinted of the principles of consistency in handwriting instruction and practice.

I also observed and personally experienced the frustration professionals were enduring in regards to handwriting practices. Teachers are profoundly talented in educating our children while juggling limited access to resources, increased academic curricula demands and larger class sizes. Occupational therapists offer valuable insights into occupations and client-centered methods of enablement, but there always seem to be more children with handwriting problems than time, support, or resources available. These are examples of an infringement on the teachers and occupational therapists' occupational rights.

This is not only an occupational injustice for our Canadian children; it is an occupational injustice for the professionals involved in the practice of handwriting, particularly, the professionals in the fields of education and occupational therapy who are involved in the instruction and remediation of handwriting. These professionals witness the daily impacts of handwriting challenges that influence all facets of a child's academic education, peer socialization and well-being. The injustice filters down becoming an occupational

injustice for the professional, when he or she does not have the tools, policies, resources, or time to effectively support these children.

Therefore, based on my personal experience and the information presented in the literature, three individuals may experience an occupational injustice in relation to handwriting: the child, the teacher and the occupational therapist. Given the inherent value of the occupation of handwriting juxtaposed with the identified gap of services, resources and time within the school and health system, and the previously described occupational injustice children and professionals are experiencing; it is clear to me that something needs to change, but how?

Carlsson (2009) suggests that it is not only an occupational therapist's role to support children in the schools; it is our responsibility to advocate for them as well. In reflection of this, I realized in order to advocate for change, I needed to better understand the complexities of the problem. I was aware of the framework of occupational justice. It was reasonable for me to explore the conditions potentially leading to the occupational injustice, to pursue a greater understanding of the complexities of handwriting and fully appreciate the factors contributing to the conditions experienced in the school system today.

1.4 Statement Of Purpose

The purpose of this study was to conduct an integrative review of the occupational therapy handwriting literature, for purposes of enhancing the understanding of the occupation of handwriting in the school system. The Framework of Occupational Justice and the principles of the Charter of Occupational Rights previously discussed were used to organize the literature into a theoretical framework and to identify the conditions leading to an occupational injustice.

1.4.1 Research Questions

The integrative review addressed the following research questions:

1. What are the structural and contextual factors found in the occupational therapy literature on handwriting?

2. What factors identified or not identified within the integrative review, are contributing to the conditions of occupational injustice?

3. Is the Framework of Occupational Justice a useful tool for guiding an integrative review of occupational therapy literature on handwriting? What are the strengths and limitations in using the framework?

1.5 METHODOLOGY

An integrative review methodology was chosen to explore the occupational therapy literature on handwriting for purposes of better understanding the occupation and the conditions contributing to an occupational injustice. An integrative review recognizes that all types of methodology and literature sources contribute valuable insights to a particular phenomenon. "Integrative reviews are the broadest type of research review methods allowing for the simultaneous inclusion of experimental and non-experimental research in order to more fully understand a phenomenon of concern" (Whittemore & Knafl, 2005, p. 547). It "is the only approach that allows for the combination of diverse methodologies" (Whittemore & Knafl, 2005, p.546). Because of this, the design enables a comprehensive understanding of a particular phenomenon or health care problem (Whittemore & Knafl, 2005). This was the most appropriate methodology because this research study explores a relatively new phenomenon: occupational justice in the context of describing an occupational therapy identified occupational performance issue: handwriting. The integrative review methodology allows for a synthesis of the literature while drawing conclusions and possibly contributing to policy, occupational therapy practice and client-based interventions.

Although handwriting has been extensively documented within the occupational therapy literature, a comprehensive literature review of handwriting using an occupational justice lens and the Framework of Occupational Justice has not been conducted before. A vast proportion of the work on occupational justice was found within the theoretical literature, while a vast proportion of the work on handwriting came from experimental literature. The integrative review design promoted the coupling of these two paradigms. The integrative review design encouraged a unique flexibility and "incorporated a wide range of purposes: to define concepts, to review theories, to review evidence, and to analyze methodological issues of a particular topic" (Whittemore & Knafl, 2005, p.548).

Beliefs and principles of occupational justice are not novel to the profession of occupational therapy. They are embedded in the foundations of the profession. The practical use of the theoretical term: occupational justice is relatively new and unused in clinical practice. The utility of using the Framework of Occupational Justice with the occupation of handwriting is unknown. Because it is a relatively new concept and framework, there is limited information available on the practical implications of using the Framework of Occupational Justice in such a manner. Choosing a methodology, which promoted flexibility and a broad collection of sources, was required given the research topic.

An integrative review design was used to gather the theoretical and experimental occupational therapy literature on handwriting. This included occupational therapy policies, professional values, theoretical paradigms, and evidenced based literature on the assessment and treatment of handwriting problems. This information was gathered to formulate a comprehensive understanding of the occupation of handwriting. The Framework of Occupational Justice was used for purposes of guiding the methodological approach along an occupational justice perspective and to identify the conditions contributing to an occupational injustice. Together the integrative review and the framework allowed for a diverse collection of sources to be categorized, evaluated, and analyzed. Adhering to the explicit and systematic methods of an integrative review including the incorporation of detailed inclusion/exclusion criteria, decision trees, and

critical quality review methods of the literature sources, rigour was enhanced thus broadening the scope and generalizations of the findings.

1.6 Summary

Malcolm Gladwell, a well know author for his provocative insights and interpretations on the implications of small-scale social events, defines a tipping point as "the moment of critical mass, the threshold, the boiling point" (2000, p. 12). The inherent value of the occupation of handwriting juxtaposed with the occupational injustice children and professionals experience and who will continue to experience if change does not occur, is my tipping point. Given my experience as a school-based occupational therapist I am compelled to advocate for the rights of children to engage in the health building occupation of handwriting by initiating this research on the injustice.

I pursued this ambitious journey of unraveling the complexities of handwriting and the conditions leading to the injustice to present them here for you to read, so that together we may create the tipping point. Akin to Gladwell's "agents of change" together we may generate the moment of critical mass; I as the "maven", who will introduce the problem, my thesis as the "salesman" to persuade you, the "connector", to link this discussion with someone you know or will know. Rendering the impact of the occupational injustice presented as memorable and optimistically, to inspire a context for change.

This chapter has introduced the meaningful occupation of handwriting and has provided a prologue to the principles and beliefs of occupational justice that are inherent in all occupational interactions and the Framework of Occupational Justice.

Chapter two provides comprehensive background literature on the history of the exploratory theory of occupational justice, principles and beliefs, occupational rights, and the Framework of Occupational Justice. Chapter two also reviews the role of occupational therapy, explores the history of handwriting and describes the contributions of the known literature reviews conducted on handwriting. Chapter three presents the methodology:

design, instruments used to maintain rigour, the search strategy, and the analysis procedures. Chapter 4 presents the analysis of the literature sources, the methodological challenges encountered, and the solutions that resulted to effectively use the Framework of Occupational Justice within this research design. Chapter 5 presents the findings of the integrated literature review. Chapter 6 presents a summary of the findings and discusses potential conditions leading to an occupational injustice, the implications for occupational therapy practice, the limitations, future research and the summary.

CHAPTER 2 BACKGROUND LITERATURE

2.1 A HISTORICAL OVERVIEW OF OCCUPATIONAL JUSTICE

Townsend and Wilcock (2004b) were noted to document "at some future point, people will ask about the history of ideas behind occupational justice (p. 249)". These two individuals, whom are credited for their contribution to the development of the principles, beliefs, and the terms *occupational justice* and *occupational injustice*, hypothesized accurately. At this point, seven years later, a historical overview of the development of the concept of occupational justice was completed. The purpose was to clarify the diverse contributions that have occurred thus far. The intentions of this historical overview are not to provide a sequential documentary of the developments. Rather, the intentions are to highlight the historical points that are significant to the development of this thesis.

2.1.1 From Social Justice To Occupational Justice: A Concept Created

The exploratory footprints of the individuals involved in the journey of defining and contributing to the ideas of occupational justice are left in the glossaries, indices, and literature citations found within the occupational therapy and health literature. Through the timescale of 1993 to present, occupational therapy literature evolved from including only the concept of social justice to defining occupational justice as a valuable, independent notion, foundational to the beliefs of occupational therapy.

In 1993, Dr. Elizabeth Townsend presented her Muriel Driver Lecture on occupational therapy's social vision. Dr. Townsend's analysis of occupational therapy's vision was "to promote social justice by enabling people to participate as valued members of society despite diverse of limited occupational potential" (Townsend, 1993, p. 176). Then, in 1997, Dr. Elizabeth Townsend and Dr. Ann Wilcock "discovered a strong synergy of ideas about justice, occupation and the convergences of those interests in what [they] began to describe as occupational justice" (Townsend & Wilcock, 2004, p.76). Over the next few years, the authors hosted numerous international workshops and presentations

on occupational justice for purposes of initiating a global, interactive, exploration of this idea (Townsend & Wilcock).

The first joint publication of Wilcock and Townsend recording the collaborative dialogue of occupational justice occurred in 2000. At that time, the idea of occupational justice was complementary to but different from social justice, "whilst social justice addresses the social relations and social conditions of life, occupational justice addresses what people do in their relationships and conditions for living" (Wilcock & Townsend, 2000b, p. 84). The authors prefaced that it might be considered unnatural to include the term occupation with principles of justice. However, Townsend and Wilcock provided a rationale for this union suggesting, "without occupational justice, the interpersonal interactions, communities, and the world, experience inequities which touch the very essence of living. While some people may find meaningful occupations, others are relegated to a life in which they are unable to develop their occupational potential or to meet the occupational challenges of their communities" (p. 84). As a result, a foundational pillar of occupational therapy's values arose.

2.1.2 The Three Interconnected Pillars Of Occupational Therapy

The developments in 2003 and 2004 led to the acknowledgment of the interconnected pillars of occupational therapy: occupation, enablement (client-centered), and occupational justice (Townsend, 2003; Townsend & Wilcock, 2004). These three pillars are perspectives informed by a developed-world, democratic practice context. They differentiate occupational therapists from other health care professionals. It has been suggested within the literature that occupational therapy is rooted in and are distinguished by these three inter-connected pillars of knowledge (Townsend; Townsend & Whiteford, 2005; Townsend & Wilcock).

2.1.2.1 Occupation

The first pillar of occupational therapy is occupation. "Occupation refers to groups of activities and task of everyday life, named, organized, and given value and meaning by

individuals and a culture. Occupation is everything people do to occupy themselves, including looking after themselves (self-care), enjoying life (leisure), and contributing to the social and economic fabric of their communities (productivity)" (CAOT, 1997, p.34). In the 2007 publication: *Enabling Occupation II: Advancing an Occupational Therapy Vision for Health, Well-being & Justice Through Occupation*, the authors capture the basic assumptions of human occupation: "occupation is a basic human need, occupation has the potential to be therapeutic, occupation affects health and well-being, occupation organizes time and brings structure to living, occupation brings meaning to life (ascribed by the culture and by the individual) and occupations are idiosyncratic" (Polatajko et al., 2007, p. 21). The value occupational therapists place on occupations resulted in it being recognized as a pillar of occupational therapy knowledge.

2.1.2.2 Enablement

The second pillar of occupational therapy is client-centered enablement. Enablement is used to describe, "therapy that uses participatory, empowerment-oriented, approaches, what occupational therapists have named client-centered practice" (Townsend & Wilcock, 2004, p. 77). Enablement is an invisible, powerful, process of self-less collaboration and partnership to achieve the occupational potential of an individual (Townsend, 2003). Enablement focuses on those who are currently disempowered to create opportunities for occupational enrichment and personal development as individually and culturally defined (Townsend & Wilcock, 2004b). Meaningful occupations go hand in hand with client-centered enablement. Because of this, enablement is recognized as an important pillar within occupational therapy knowledge.

2.1.2.3 Occupational Justice

The third pillar of occupational therapy is rooted in occupational justice. Occupational justice recognizes that humans are occupational beings who need and want to participate in occupations (Townsend & Wilcock, 2004, 2004b). Opportunities for the engagement and participation in meaningful occupations are a key determinant of health, well-being, life meaning, and social inclusion (Townsend & Wilcock, 2004; Padilla et al, 2004).

Stadnyk et al. (2010) indicated "the concept of occupational justice juxtaposes moral, ethical, and political ideas of justice on occupation. A focus on occupational justice means that we look at diverse occupational needs, strengths, and potential of individuals and groups, while at the same time considering issues of rights, fairness, empowerment, and enablement of occupational opportunities" (p. 331). Therefore the concept also refers to promotion of social and economic change to increase awareness, resources, and equitable opportunities for diverse occupational participation that enable people to meet their potential, experience well-being and full citizenship (Padilla et al.; Stadnyk et al.; Townsend & Wilcock). Because occupational justice is a relatively new term there may be many occupational therapists that might not know that this term is a pillar of occupational therapy knowledge. However their practice inherently is rooted in the concept of occupational justice by promoting client-centered, meaningful occupations.

2.1.3 Occupationally Just World

As a result of these three pillars of occupational therapy knowledge, the occupational rights of an individual are formed. Townsend and Wilcock (2003) proposed a Charter of Occupational Rights (see Figure 2.1), which embeds ethical, moral, and civic principles of the occupational justice paradigm (Townsend, 2003; Townsend & Wilcock, 2004, p. 80). Occupational justice becomes an outcome of society when the occupational rights are achieved for all, thus establishing an *Occupationally Just World*. This is defined as:

> "A utopian vision of a world that is governed in such a way as to enable individuals, families, communities and populations to flourish by doing what they decide is most meaningful, useful and environmentally sustainable to promote health, well-being and social inclusion for individuals, their families, communities, and nations" (Christiansen & Townsend, 2010, p.421).

Charter of Occupational Rights			
Right to experience occupation as meaningful and enriching	Right to develop through participation in occupations for health and social inclusion.	Right to exert individual or population autonomy through choice in occupations.	Right to benefit from fair privileges for diverse participation in occupations.

Figure 2.1 Charter of Occupational Rights

2.1.4 Occupational Injustice

Alternatively, when the occupational rights of an individual, community, or nation are not respected or overruled, this leads to conditions of occupational injustice. An occupational injustice occurs "when participation in daily life occupations is: barred, trapped, confined, segregated, restricted, prohibited, undeveloped, disrupted, alienated, imbalanced, exploited, deprived, marginalized, or segregated" (Townsend, 2003, p. 9).

2.1.4.1 Outcomes Of An Occupational Injustice

Denial of occupational participation jeopardizes the health and well being of all aspects of daily life experienced by individuals, communities, and nations (Townsend, 2003; Townsend & Wilcock, 2004b; Wilcock & Townsend, 2000b). Occupational injustices result in enduring occupational experiences, which become taxing on the individual, community, or nation (Townsend & Wilcock). Townsend and Wilcock suggest that it is difficult to predict the potential for *Dis-Ease* or outcomes of injustice.

Dis-Ease, is described as the real medical symptoms which result from the stressful experience of the injustice (Stadnyk et al., 2010; Townsend & Wilcock, 2004b). Stadnyk et al. illustrate, "people develop symptoms of dis-ease that can range from individual fatigue and immune system disorders to international civic disturbance and social disintegration of health, education, and other systems" (Stadnyk et al., 2010, p. 338). Many authors have identified that the medical symptoms may be a result of different

types of occupational outcomes: occupational alienation, occupational apartheid, occupational deprivation, occupational disruption, occupational imbalance, and occupational marginalization (Kronenberg & Pollard, 2005; Townsend, 2003; Townsend & Wilcock, 2004, 2004b; Wilcock, 1998, 2006; Whiteford, 2010).

Opportunities to engage in meaningful occupation create a positive self-image and empowerment. When occupations lack meaning or purpose, self-image and confidence are distorted (Townsend & Wilcock, 2004b). *Occupational alienation* is described as the lack of physical, mental, and social enrichment resulting from meaningless and purposeless engagement in occupation (Stadnyk et al., 2010).

Occupational marginalization as described by Stadnyk et al. (2010) occurs when "people are not afforded the opportunity to participate in occupations and to exert choices and decision making related to occupational participation" (p. 339). It is suggested, "marginalization often occurs because individuals or groups are discriminated against" (Stadnyk et al., 2010, p. 339). The extreme version of occupational marginalization may lead to an occupational apartheid. *Occupational apartheid,* "results from political constraints which may extend to encompass all aspects of daily living and human occupation through legal, economic, social, and religious restrictions, and can be found as a consequence of chronic poverty and inequality in many countries across the globe" (Kronenberg & Pollard, 2005, p. 66).

Occupational deprivation is described as, "deprivation of occupational choice and diversity because of circumstances beyond the control of individuals or communities" (Wilcock, 2006, p.343). Townsend and Wilcock (2004b) suggest that the injustice becomes obvious when society tolerates the deprivation of occupational engagement in some individuals and not in others. *Occupational disruption* as described by Whiteford (2010) illustrates that this injustice is similar to occupational deprivation. However the factors that distinguish the injustice are considered temporary and due to a situation with which the individual has some control over. After a period of disruption, the individual may return to a fully functioning, occupationally just existence as they previously did.

Whiteford provides the example of an individual who becomes injured during a chosen sporting activity. The individual may not be able to participate in typical occupations while injured, however, after the injury heals the person may return to full functioning.

Occupational imbalance is described as an imbalance of time allocated between occupations. Similar to an occupational disruption, the imbalance may be temporary. The imbalance is partly due to personal motivation and ability and partly due to social expectations (Stadnyk et al. 2010; Townsend & Wilcock, 2004b).

The outcomes of occupational injustice presented share different titles and characteristics of the injustice. However, the underlying theme is similar; the occupational rights of the individual are not being achieved thus, the engagement in an occupation is prohibited, underdeveloped or meaningless for the individual. Occupational injustices occur every day in every subtle or transparent, shape or form. An occupational injustice may occur at any level in society, by definition, it is illustrated that any individual may experience an occupational injustice. It has been revealed; the impacts of occupational injustices are far reaching, often jeopardizing health, well-being, and equality.

2.2 Exploratory Theory Of Occupational Justice

In 2004, Townsend and Wilcock provided a significant contribution to the understanding of occupational justice by illustrating the development of an Exploratory Theory of Occupational Justice (2004b) (see Figure 2.2). The authors suggested that providing "definitive declarations about occupational justice are presumptuous at this early stage of inquiry" (Townsend & Wilcock, 2004b, p.248). The concepts explored within the exploratory theory included: "ideas, reasoning, a set of beliefs and principles, and distinctions between occupational and social justice" (Townsend & Wilcock, 2004b, p. 248). The Exploratory Theory of Occupational Justice led to the introduction of the practical frameworks of occupational justice derived from a critical theory perspective, including the Participatory Occupational Justice Framework (Townsend & Whiteford, 2005) and the Framework of Occupational Justice (Stadnyk, 2007, 2010). The ideas,

beliefs and principles of occupational justice were explored first. Then, an overview of the frameworks found within the literature, were presented.

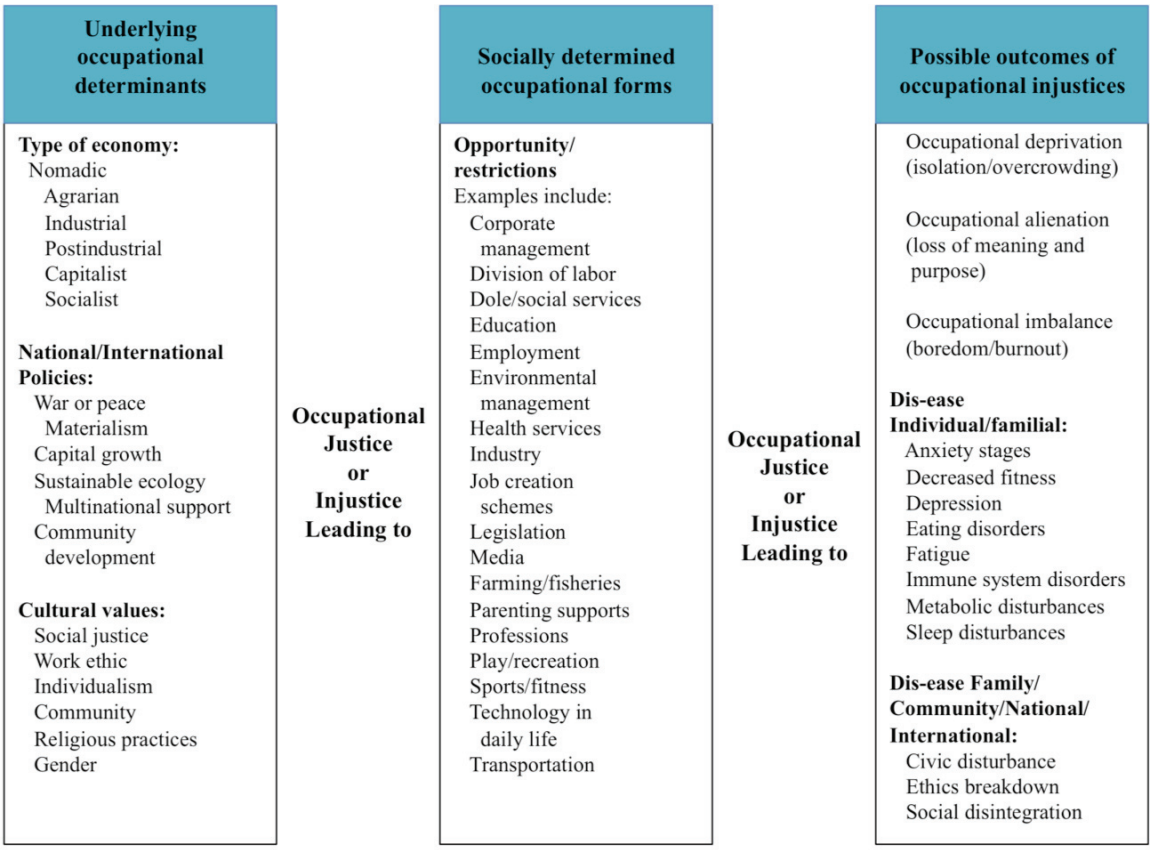

Figure 2.2 An Exploratory Theory of Occupational Justice

Source: *CHRISTIANSEN, CHARLES; TOWNSEND, ELIZABETH, INTRODUCTION TO OCCUPATION: THE ART AND SCIENCE OF LIVING, 1st Edition, © 2004. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ*

2.2.1 Beliefs And Principles Of Occupational Justice

Townsend and Wilcock (2004b) have articulated four beliefs and four principles about occupational justice, "the concept of occupational justice rests on the idea that individuals are different and have different needs" (p. 253). The development of the Exploratory Theory of Occupational Justice was founded on these core beliefs and principles. The beliefs of occupational justice, as described by Townsend and Wilcock (2004b, p.253) include:

(1) Humans are occupational beings
(2) Humans participate in occupations as autonomous agents
(3) Occupational participation is interdependent and contextual
(4) Occupational participation is a determinant of health and quality of life

The first of the four beliefs, express humans engage in occupations at every moment of their life. Although the meaning derived from the occupation may vary, engagement is essential. “Humans need and want to be occupied in various ways and for various purposes” (Stadnyk et al. 2010, p. 340). The second belief contributed to the development of occupational justice from the perspective of client-enablement. Humans want and need to pick and choose their occupations. This creates self-fulfillment because self-worth is derived from autonomy (Stadnyk et al.). The third belief recognizes that although humans are autonomous, they are only as autonomous as the context of their environment allows. This establishes the influence the environment has on the ultimate autonomy of individuals (Stadnyk et al.). The fourth belief illustrates why individuals engage in occupations; for health. The definition of health is not a result of lack of disease or impairment. It is based on the concept that as autonomous beings, individuals choose to participate in activities which they derive meaning from (Stadnyk et al.).

The four principles of occupational justice as described by Townsend and Wilcock (2004b, p. 253) include:

(1) Empowerment through occupation
(2) Inclusive classification of occupations
(3) Enablement of occupational potential
(4) Diversity, inclusion, and shared advantage in occupational participation

The first of the four principles of occupational justice, as Stadnyk et al. (2010) described, “to feel empowered is to generate feelings of personal drive, motivation, purpose, confidence, identity and even joy” alternatively “to act in an empowered way is to behave assertively, to be decisive or to be reflective and confident about the actions of oneself or a group, family, or community” (p. 344). The second principle describes people have the

right for the opportunity to participate in the activities of choice, without being restricted by classifications. The third principle describes that all individuals regardless of differences, should be encouraged to make their own decisions in occupational engagement (Stadnyk et al.). Lastly the fourth principle recognizes that all members within a society have different occupational capacities and therefore have the right to occupational equity and social inclusion (Stadnyk et al.). When the beliefs and principles of occupational justice are respected and valued within society, this leads to an occupationally just world.

2.3 Framework Of Occupational Justice

Dr. Robin Stadnyk is acknowledged for refining the exploratory theory of occupational justice (see Figure 2.3). The Framework of Occupational Justice (Stadnyk 2007, 2010) encourages an exploratory, critical theory perspective for the individuals who use it. This process is used to identify and examine the variables contributing to the outcomes of occupational justice or injustice within our society.

2.3.1 Structural Factors

The structural factors introduced in Townsend and Wilcock's exploratory theory of occupational justice were also included within the Framework of Occupational Justice. Numerous invisible and visible factors identified in the framework contribute to the conditions of occupational justice. Structural Factors regulate where, when, with whom, and how occupations can occur (Townsend & Wilcock, 2004b). The structural variables are the result of unconscious, interconnected, power conflicts, competing interests, and visions of people, which play a lead role in determining the enablement and participation of individuals and communities in occupations (Townsend & Wilcock).

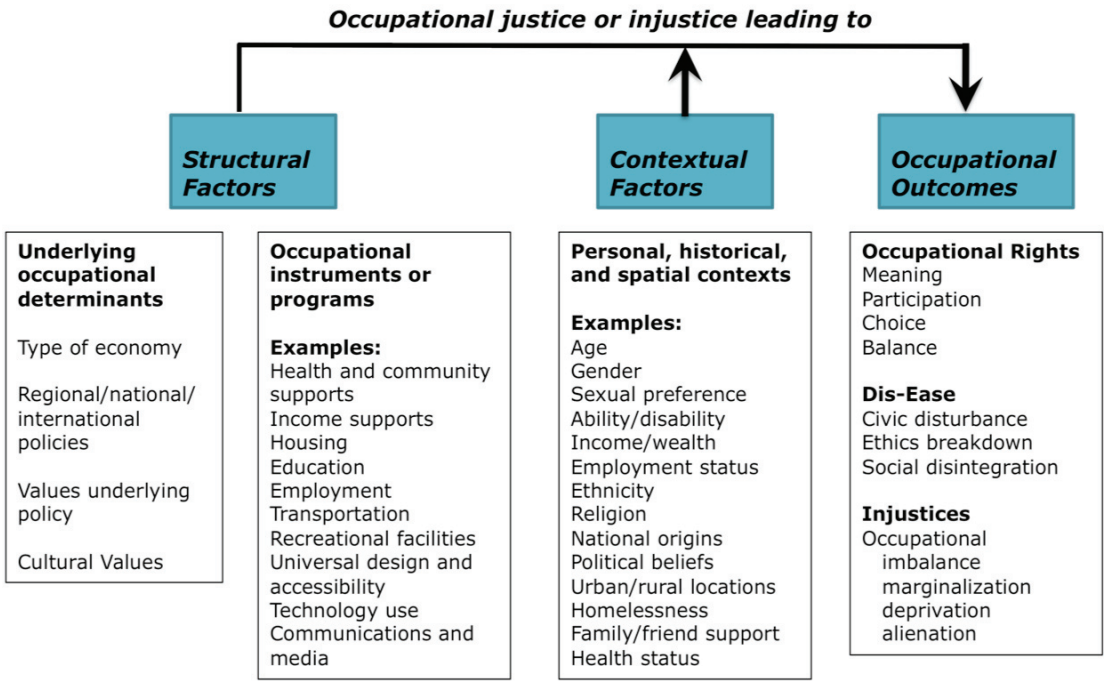

Figure 2.3 Framework of Occupational Justice

Source: *CHRISTIANSEN, CHARLES; TOWNSEND, ELIZABETH, INTRODUCTION TO OCCUPATION: THE ART AND SCIENCE OF LIVING, 2nd Edition, © 2010. Reprinted by permission of Pearson Education, Inc., Upper Saddle River, NJ*

There are two structural levels: Occupational Determinants and Occupational Forms. Occupational determinants are the occupational experiences and environments including economic policy, values, and culture (Townsend & Wilcock, 2004b). These factors impact how an occupation is respected and rewarded, and determine who will participate in them. They are embodied within the role or functions of the occupational forms. Occupational forms are instruments or programs such as types of technology, health care, parenting, education, employment, and so forth (Townsend & Wilcock). Occupational forms are experienced differently by different people and are governed by occupational determinants (Townsend & Wilcock). The occupational forms tangibly reflect the underlying policies or values. The occupational determinants and occupational forms establish or define the structural factors.

2.3.2 Contextual Factors

Contextual Factors are described as the individual, community, or nation's biological, social, and cultural characteristics (Stadnyk et al., 2010). In Townsend & Wilcock's (2004b) exploratory theory of occupational justice, the contextual factors were detailed within occupational determinants and forms. Stadnyk (2007, 2010) however, represented the contextual factors as a comprehensive and separate factor in the Framework of Occupational Justice (see Figures 2.2 and 2.3). The inclusion of the contextual factors is another diagrammatic and foundational theoretical difference between the exploratory theory and the framework. The inclusion of the contextual factors further illustrates that people may experience the outcomes of justice differently as a result of the individual's biological, social, or cultural characteristics or situation.

Occupational justice is served when the structural and contextual factors enable rather than disable the participation in occupations (Townsend, 2003). When the conditions lead to occupational justice, individuals, communities, and nations experience an equitable right to choose and develop through participation in enriching occupations (Townsend & Wilcock, 2004). Using the Framework of Occupational Justice derived from a critical theory perspective, an occupational therapist is able to explore the factors and the conditions leading to the occupational injustice to better understand the occupation and to possibly advocate for change. Using the framework in this manner coincides with the beliefs of Kronenberg and Pollard who suggest that occupational therapy practitioners are ethically obligated to identify and recognize how particular variables contribute to occupational injustice and advocate for equity in meaningful occupations. The Framework of Occupational Justice is one of three frameworks found within the literature to explore the variables contributing to occupational justice. The two additional frameworks were described in the next section.

2.4 Exploring Alternative Frameworks Of Occupational Justice

The history of occupational justice was introduced within the beginning of this chapter. The Exploratory Theory of Occupational Justice (Townsend & Wilcock, 2004b) was the

preparatory paradigm which led to the development of frameworks that explore occupational justice. The Framework of Occupational Justice (Stadnyk, 2007, 2010) illustrates where we are today in the evolution. It is one of the most current and frequently discussed models of occupational justice in the occupational therapy and health literature. Two other frameworks were identified within the literature. (1) Participatory Occupational Justice Framework (Townsend & Whiteford, 2005) focuses on population-based processes of practice (2) Framework for Addressing Issues of Occupational Justice (Wolf, Ripat, Davis, Becker & MacSwiggan, 2010) describes at the individual level, the process for addressing occupational justice issues in practice. These two frameworks were described further.

The Participatory Occupational Justice Framework (see Figure 2.4) described by Townsend and Whiteford (2005) illustrates how everyday injustices experienced in ordinary life by both wealthy and poor nations, may be approached using theoretical processes rather than prescriptive techniques. Townsend and Whiteford suggested that this framework might be used for "thoughtful experimentation, rather than as techniques to be adopted" (Townsend & Whiteford, 2005, p.123). Similar to the Framework of Occupational Justice, the foundation of the participatory framework has also been developed on the three pillars of occupational therapy: occupations, enabling client-centered practice and occupational justice. The six interrelated processes of the framework include: (1) Analyze and coordinate resources (2) Negotiate a justice framework (3) Analyze occupational injustices (4) Negotiate program designs, outcomes and evaluations (5) Evaluate client-specific strengths, resources and challenges (6) Plan, implement and evaluate client-specific services (Townsend & Whiteford, 2005, p.114). The authors reported the identified processes were influenced by the Occupational Performance Process (OPP: Canadian Association of Occupational Therapists, 1997), and the Canadian Model of Occupational Performance (CMOP: Canadian Association of Occupational Therapists, 1997). It was theorized that because these two models are frequently used in practice, embedding them into the participatory occupational justice framework would enable efficiencies in practice (Townsend & Whiteford, 2005).

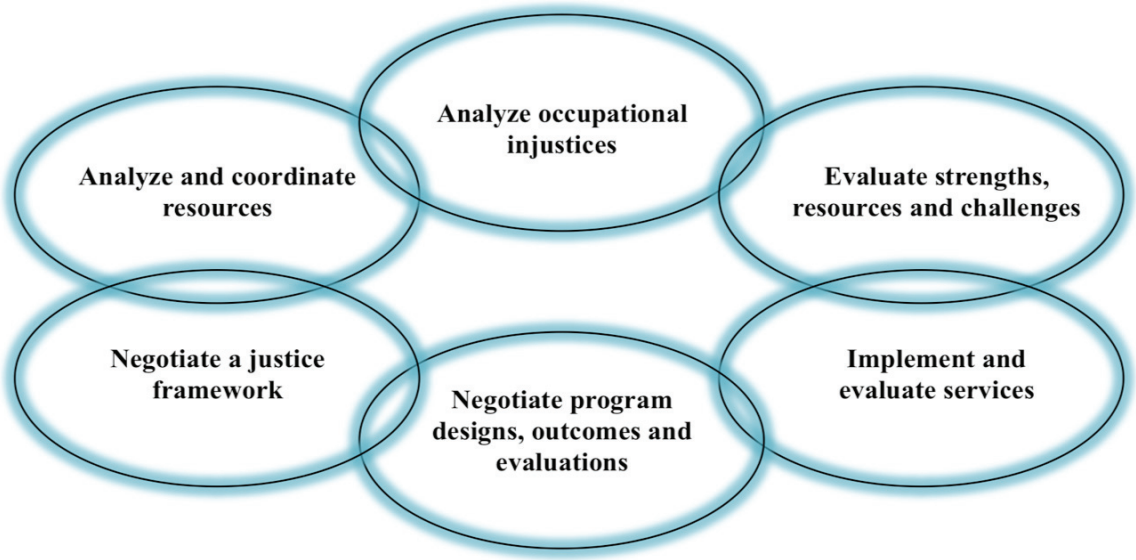

Figure 2.4 The Participatory Occupational Justice Framework (Townsend & Whiteford, 2005).

Source: This figure was published in Kronenberg, F., Simó Algado, S., Pollard, N. *Occupational therapy without borders. Learning from the spirit of survivors.* Townsend, E., & Whiteford, G., A participatory occupational justice framework. Population-based processes of practice. *(*p. 113). Copyright Elsevier Churchill Livingstone, (2005).

Alternatively, Wolf et al. (2010) illustrated a clinically applicable framework that looks at the individual level of injustice. The systems and environmental barriers are described as macro, meso or micro (Wolf et al., 2010). The barriers are: external to the individual (environmental), internal to the individual (person) or in the context of the individual (historical, spatial or relational). Wolf et al. (2010) proposes a process for addressing occupational justice issues in practice that can be used to identify avenues of influence and to develop a set of client-centered strategies (p.17).

This section explored the theory of occupational justice; the lens through which the integrative review was conducted. The next three sections will address occupational therapy practice, an overview of the history of handwriting and the current occupational therapy literature reviews conducted on handwriting.

2.5 School-Based Occupational Therapy

Christiansen and Townsend (2010) defined occupational therapy as:

> "a profession practiced in many nations. Occupational therapy is based on knowledge about humans' intrinsic needs and desires to explore the world and engage in occupational pursuits that are necessary, engaging, meaningful, and purposeful, and that the social, spiritual, physical, and psychological beliefs of occupational engagement are essential to health, well-being and equitable social inclusion" (Christiansen and Townsend, 2010, p. 421).

School-based occupational therapists work within the educational environment. They may work in one school or a variety of schools depending on the contract or partnership. School-based occupational therapists are either hired by healthcare boards and contracted to or partnered with schools, are employed directly through the school board, or work privately within the schools.

School-based occupational therapists work collaboratively with teachers to identify health concerns impacting educational engagement and academic outcomes. Health concerns are viewed in the context of the occupational justice belief that occupational participation is a determinant of health and quality of life. "School-based occupational therapy is directed toward furthering educational goals considering all aspects of the student's function or occupational performance" (CAOT, 1991 as cited in Reid, Chiu, Sinclair, Wehrmann & Naseer, 2006, p. 215).

A major role for school-based occupational therapists is to support the development and acquisition of functional handwriting skills within the educational environment. School-based occupational therapists work within an occupational justice framework to support children with handwriting difficulties, although some therapists might not be aware that they are working within this framework. Carlsson (2009) stated, "to practice from an occupational justice framework is to enable clients the right to experience occupation as meaningful and enriching" (p.7). As the profession of occupational therapy evolves, "the occupational therapist's job will be to address outcomes of occupational justice by

enabling change at various levels. This includes from the level of the student through to advocating for change at a classroom and school community level and even a legislative level, and when necessary, to enable occupational engagement issues at the level of impairment" (Carlsson, 2009, p. 8). As a profession, it is important to understand the evolution of written output to better prepare us to enable and advocate for the occupation of handwriting. Describing the history and the literature reviews conducted on handwriting was the next step in this exploration.

2.6 Handwriting Defined

Handwriting is a term used to describe the motor act of manual written communication. The term handwriting is inclusive of two specific forms of manual written communication: manuscript and cursive writing. Manuscript writing is a term used synonymously with printing. Manuscript writing refers to the written product of disconnected letters which form a word. Alternatively, cursive writing results in the written product that represents a continuous connection of strokes forming letters to produce a word.

2.7 History Of Handwriting

"All the errors possible to penmanship are daily presented on the boards, and idiosyncrasies in writing are carried by pupils from room to room. These are survivals of bad types" (Smith, 1892, p. 9).

The history of the teaching and development of handwriting captured in the eloquent language and date of the citation above, illustrates handwriting and handwriting problems have long been chronicled within the literature. The history of handwriting was presented from the perspectives of two authors, Dougherty (1917), and Wallace and Schomer (1994). Wallace and Schomer's historical perspective on handwriting is that "the prevalent handwriting style taught in schools has been simplified over the years in order

to meet the needs of a constantly changing society" (Wallace & Schomer, 1994, p. 414). This is supported by a look back on five periods in history, which are found to identify the changes in the teaching practices since the late sixteen hundreds and included: (1) Colonial Period (1600-1800), (2) Transitional Period (1800-1850), (3) Period of Independent Elaboration of American Systems (1850-1890), (4) Vertical Writing Movement (1890-1900), Combination of Commercial and Scientific Influences (1900-1916) (Dougherty, 1917).

Dougherty (1917) described the Colonial Period, illustrated the nobility of handwriting instruction; marked by dedicated schools for the purpose of teaching this art and the existence of licensing teachers. The use of traditional writing tools resulted in a considerable amount of time for gathering and preparing the writing instruments: lead plummets gathered for pencils, sharpened goose quills for pens, retrieved birch bark for copy. Ink was prepared using nutgalls; an outgrowth on a plant by a parasitic insect, soaked in rusty nail water. Teachers instructed to children individually, whereas in the Transitional Period teachers instructed via class instruction.

Dougherty (1917) described during the Transitional Period, lead pencils replaced the plummet, steel pens replaced the quill, and writing books replaced the birch. A focus was placed on baseline and sizing through the introduction of the tool similar to the music staff, which marked up to five lines at a time. A new method for instruction was introduced which prioritized elementary strokes. Letters were described by curves, loops, and turns verbalized by the teacher, not by the teacher naming the letter, while fingers were taped to pens to restrict finger movement.

During the 1850-1890s, the teaching methods of handwriting were questioned, which lead to the introduction of the Spencerian method (Dougherty, 1917). Spencer published a penmanship style method which was accepted in the New York school system and eventually became the most widespread instructional method (Wallace & Schomer, 1994). This particular style was coupled with handwriting books organized in developmental order (Dougherty). Children were expected to start off with the elementary

strokes and progress to more complex strokes, which included arm and forearm movements and continuous contact of pencil on paper (Wallace & Schomer).

The Vertical Writing Movement followed, characterized by children sitting face front-on to their writing, versus to the side (Dougherty, 1917). This was followed by a period in the early 1900s which prioritized efficiencies of handwriting. Standardization was introduced. Manuals on how to teach writing were published leading to the emergence of Palmer's method for teaching cursive writing (Wallace & Schomer, 1994). Drill methods, metronomes, rhythm by counting to keep pace, were introduced. Palmer made Spencerian letters simple; he reduced the slant and connected upper case and lower case letters (Wallace & Schomer, 1994). Teachers were required to get a diploma or a certificate to teach the proper ways of handwriting. The Ayres Scale was the first method used to grade handwriting performance. This period also marked the era of handwriting research methods. Moving pictures of children's writing was used to understand how the child printed and as an outcome measure for quality. This led to the importance of good position, to free movements in the fingers and arm (Dougherty, 1917).

The introduction of manuscript occurred in Boston, 1921, by Marjorie Wise (Wallace & Schomer, 1917). Hildreth (1960, 1963) reported that the introduction of manuscript was to never provide a foundation for cursive, rather, to replace cursive writing altogether (as cited in Wallace & Schomer, 1994). It is reported that education teachers, particularly those teaching the younger grades were concerned about the fine motor skills required for cursive. Therefore, to mitigate their concerns, these teachers only taught the manuscript form of writing (Wallace & Schomer). The introduction of manuscript also supplanted dictated, mechanical copying. Children were learning through reading and writing. Nowadays, as Wallace and Schomer maintain, "cursive handwriting instruction has outlived much of its usefulness and its functional purpose has been replaced by the use of communication-related technology… a decline in the importance of cursive is reflected by the descent in the standards used to evaluate it" (Wallace & Schomer, 1994, p. 416).

The history of handwriting from the 1600s to the 1990s illustrated, the refinement of cursive handwriting skills has led to the almost disappearance of this form of written output in the educational system today. In the past hundred years, manuscript and technology forms have been taking over where cursive writing has ceased to progress. The next section summarized the literature reviews on handwriting conducted in the past fifteen years. The purpose of this historical review was to identify if a connection has been made between handwriting and the term occupational justice and to identify if other reviews on handwriting were conducted using an integrative review research methodology.

2.8 Literature Studies Reviewing Handwriting

The handwriting research and literature conducted within the fields of occupational therapy, psychology, education and biomechanics is extensive and growing.
Six literature reviews on handwriting have been conducted within the occupational therapy literature over the past fifteen years (Feder & Majnemer, 2003; Feder & Majnemer, 2007; Feder, Racine, & Majnemer, 2008; Freeman, MacKinnon, & Miller, 2005; Marr & Cermak, 2001; Racine, Majnemer, Shevell, & Snider, 2008). Additionally, one literature review from educational psychology was discovered: Graham and Weintraub (1996). These literature reviews were explored to identify if any used an integrative review methodology or used the term occupational justice in context of the literature findings.

Feder and Majnemer (2003) published a review of five children's handwriting evaluation tools and their psychometric properties within the journal *Physical and Occupational Therapy in Pediatrics.* Although this research contributed to occupational therapists' understanding of the psychometric properties of the evaluation tools used in practice, this literature review did not use the term occupational justice or an integrative review methodology.

Feder and Majnemer (2007) published a review of handwriting development, competency and intervention in *Developmental Medicine & Child Neurology.* This research review described the development of handwriting, the performance components required for functional handwriting and remediation. An integrative review was not used and the term occupational justice was not referenced.

Feder et al. (2008) published a review on handwriting performance and interventions in *The Israel Journal of Occupational Therapy*. Occupational therapy intervention processes for handwriting were reviewed including: a review of handwriting performance, occupational therapy evaluations and interventions, functional performance components which make up the complex skills of handwriting, extrinsic factors, such as teacher instruction contributing to handwriting performance and intervention. The literature sources were contributed from the fields of occupational therapy, psychology and education. Based on the findings that children's handwriting improved regardless of intervention type, the authors recommended more use of randomized clinical trials. No reference to the term occupational justice was made, and an integrative review was not used.

Freeman et al. (2005) published a review in the *Physical & Occupational Therapy in Pediatrics*. The review described keyboarding for students with handwriting problems. The review identified, children who have handwriting problems need to be able to keyboard as fast as they handwrite. The literature review also described the keyboarding skills required for functional keyboarding performance. The authors identified, similar to handwriting, keyboarding skills needs to be taught. The term occupational justice was not referenced and an integrative review was not used.

Marr and Cermak (2001) published a review in the *Israel Journal of Occupational Therapy.* The review focused on the exploration of how the handwriting characteristics change throughout a child's educational development and examined if the quality of handwriting remains consistent. Due to the limitations of their study, Marr and Cermak identified limited evidence existed in identifying the patterns of handwriting development

in younger children. There was no mention of the term occupational justice nor was an integrative review used.

Racine et al. (2008) published a review of studies on handwriting performance in children with attention deficit hyperactivity disorder (ADHD) within the *Journal of Child Neurology*. The results of the literature search identified that research on handwriting and ADHD is limited. The authors did not mention the term occupational justice, nor was an integrative review design used.

Finally, a review of handwriting research by Graham and Weintraub (1996) provided a retrospective perspective of the research developments in handwriting. In addition, this review established implications for instruction and directions for future research. As comprehensive as this review was, a limitation to this review was that the literature sources were predominantly gathered from within the field of educational psychology during the nineteen eighties to nineteen nineties. Not surprisingly, the occupational therapy term occupational justice was not identified within this educational psychology review, nor was an integrative review methodology used.

The small sample of literature reviews conducted over the past fifteen years illustrated a comprehensive summary of the literature sources on handwriting. None of the reviews used an integrative review approach to collect and summarize experimental and theoretical sources together. In addition, none of the literature reviews collected specifically from the fields of occupational therapy, were found to use the term occupational justice. Although the term occupational justice was not identified within the literature reviews, it could be argued that the occupational therapy authors alluded to the constructs from the exploratory theory of occupational justice. As an example, Marr and Cermak (2001) commented on the contextual factors of the child and the impacts this may have on handwriting development. Marr and Cermak also identified that a high proportion of the literature sources were collected from European studies. Marr and Cermak described occupational determinants, such as the type of handwriting curriculum used in Northern European countries. They suggested these may have skewed the

literature review to primarily reflect European versus worldly handwriting practices (Marr & Cermak).

Although these literature reviews may have alluded to the constructs of occupational justice, these reviews captured an occupational therapy area of practice which is oriented in a positivist research perspective and world view. It is not surprising that the authors would not include occupational justice as part of their language or research perspective, because occupational justice is derived from a critical theory perspective and world view, not a positivist research perspective. As a result of the type of research perspective employed, these literature reviews have illustrated there is a gap in the studies published on handwriting.

2.9 Summary

The introduction of this review illustrated possible conditions contributing to an occupational injustice in handwriting. This led to the discussion of the three foundational pillars of occupational therapy knowledge: occupation, client-centered enablement, and occupational justice. The history of occupational justice was described and the terms were defined. An overview of the exploratory theory of occupational justice, the beliefs and principles, and the charter of occupational rights were articulated. It has been established that when the occupational rights of an individual are preserved, allowing for engagement in health building occupations, the conditions lead to an outcome of occupational justice. It has also been established that the conditions an individual, community, or nation may experience as a result of unequal opportunities for meaningful occupational engagement, leads to an outcome of occupational injustice. Three clinically applicable frameworks were presented and demonstrated that practical methods for exploring occupational justice from a critical theory perspective, exist in the literature.

A major role for school-based occupational therapists is to support the acquisition and intervention of functional handwriting skills. As illustrated within the history of handwriting, over the past four hundred years, substantial modifications to the

handwriting curricula have been made. Previous reviews have described and discussed the occupation of handwriting. Although, it was established that a comprehensive review from the perspective of Occupational Justice identifying the factors impacting the occupation of handwriting, remains to be published. Furthermore, no literature review completed from 1995-2010 was identified to use an integrative review methodology.

The purpose of this study was to conduct an integrative review of the occupational therapy handwriting literature, for purposes of enhancing the understanding of the occupation of handwriting in the school system. The Framework of Occupational Justice and the principles of the Charter of Occupational Rights were used to organize the literature into a theoretical framework and to identify the conditions leading to an occupational injustice.

This review is unique from other literature reviews on handwriting. It is unique because it uses an integrative review design to guide the identification of the factors contributing to the conditions of occupational injustice. It is also unique, because it implements the theory and framework of occupational justice from an atypical perspective, a research perspective. Occupational injustices are usually described from the perspective of the individual, community or nation. The external, internal and contextual barriers of the individual are described to illustrate the occupational injustice. However, in this research review, the conditions contributing to an occupational injustice are gathered from the perspective of the occupational therapy literature on handwriting. This perspective might promote a multi-perspective view of the occupational injustice by identifying the factors impacting the student, occupational therapist and the teacher involved in handwriting. The next chapter describes the methodology used to conduct the integrative review.

CHAPTER 3 METHODOLOGY

3.1 Integrative Review Study Design

This study used an integrative review methodology. Whittemore and Knafl (2005) summarized Broome's (1993) definition of an integrative review as "a specific review method that summarizes past empirical or theoretical literature to provide a more comprehensive understanding of a particular phenomenon or healthcare problem" (Whittemore & Knafl, 2005, p. 546). A diverse sampling method was chosen to gather an assorted collection of the theoretical and experimental, occupational therapy literature on handwriting to formulate a comprehensive understanding of the occupation. The Framework of Occupational Justice was used for purposes of organizing the research literature into a theoretical framework of occupational justice. The integrative review design and the framework together ensured that the diverse collection of literature sources obtained, provided a critical perspective of the conditions contributing to an occupational injustice. Decisions regarding the five stages of the integrative review process: problem identification, literature search, data evaluation, data analysis, and presentation (Whittemore & Knafl) were made to establish research fidelity. The methodological processes of an integrative review were explored within this chapter.

3.2 Problem Identification

The PICO method is the process for constructing a well-built clinical question. The PICO method identifies: the clinical problem, patient, or population (P), the characteristics specific to the intervention (I) the comparison to no intervention (C) and the outcome (O) (University of Washington Healthlinks, 2011).

The PICO method was used to guide the establishment of the first stage of this integrative review: problem identification. This stage included the development of the statement of purpose and the clinical questions. Accordingly, the first step of the PICO method was to define the variables of interest. The problem, patient and population (P) were defined.

The problem was identified as handwriting, specifically, the structural and contextual factors of handwriting and occupational justice. School-based education, children, and pediatrics were defined as the population of focus because it is at this stage in development when handwriting is introduced and because it incorporated the clinical population that I work with. Occupational therapy and handwriting literature was also identified as part of the population of interest. The characteristics specific to the intervention (I) were defined as an integrative review methodology, occupational therapy, the framework of occupational justice, and the charter of occupational rights. The comparison (C) was defined as the findings within the handwriting literature. The outcomes (O) were defined as the outcome of occupational justice or occupational injustice and an enhanced understanding of handwriting. These identified variables enabled the formation of the research purpose: to conduct an integrative review of the occupational therapy handwriting literature for purposes of enhancing the understanding of handwriting in the school system and to identify the conditions leading to an occupational injustice, using the Framework of Occupational Justice and the principles of the Charter of Occupational Rights.

The sampling frame was defined as a Diverse Sampling Frame. This meant, a diverse collection of the literature from all types of experimental and non-experimental research designs and theoretical sources were included if available. The information gathered from the literature sources were synthesized to provide a comprehensive and unbiased representation of the literature and to identify the factors leading to the conditions of injustice.

3.3 Literature Search Strategy

The literature search stage of this integrative review was largely influenced by a handwriting systematic literature review conducted by Graham and Weintraub (1996) titled: A Review of Handwriting Research: Progress and Prospects from 1980 to 1994. This literature review provided a thorough summary of the publications related to handwriting available from 1980 to 1994 and transparently detailed an overview of the

methodology employed, including the inclusion/exclusion criteria, search terms, databases, and publication dates. However, an overview of the analysis of the literature sources was not provided within the publication.

A similar search strategy to Graham and Weintraub's (1996) review was adopted to guide this integrative review, so to reflect the depth and breadth of the handwriting literature available. The search terms were modified and additional terms were included to reflect the objectives of the study. A research librarian was consulted to ensure the most appropriate search terms were selected. Quality criteria instruments were also developed and included because it was thought that the lack of these instruments might decrease the rigour of the literature review. The literature search process, including the search terms, databases, additional search strategies, and the inclusion and exclusion criteria for determining relevant sources were presented within the next sections.

3.3.1 Search Terms

As previously mentioned, the intention for this integrative review was to identify search terms, which would encourage a diverse collection of sources. The most appropriate literature sources would pertain to the problem, concepts, and targeted population previously identified and described using the PICO method.

The search terms identified were to refine the information collected on handwriting. The search term "handwriting research" was harvested from Graham and Weintraub's (1996) literature review. It was refined to "handwriting" because this study used an integrative review methodology. It was hypothesized that including the term "research" would restrict the comprehensive collection of diverse methodologies, particularly from the theoretical and non-experimental literature sources. The term "handwriting" is considered a generic term used to describe the motor act of written communication, which includes the specific written output forms: printing, manuscript, and cursive writing. These terms may be used interchangeably within the literature and daily practice. Therefore, for the purposes of using a consistent search strategy, in which very few terms are used, the

search terms were limited to only include the generic term: handwriting. The truncation of this search term, represented with an asterisk was also used: handwrit*.

In consideration of the identified "population" variables previously established using the PICO method, additional search terms were also created to search the grey literature. These additional search terms included: "occupational therapy", "school-based occupational therapy", and "curriculum". The terms "occupational therapy" and "school-based occupational therapy" were searched using exact phrasing, in which the phrases were enclosed in quotes.

3.3.2 Piloting The Search Strategy

A pilot of the search strategy was completed. The pilot was conducted to inform subsequent decisions on the search methodology and to identify if the search terms "handwriting" and "occupational therapy" were able to obtain the breadth of handwriting literature Graham and Weintraub (1996) obtained.

Graham and Weintraub's (1996) literature sources were primarily obtained using the educational resources database (ERIC). Therefore, the information obtained and included in their review was predominantly influenced by educational-psychology literature sources. However, for this integrative review, in addition to the psychology literature, the occupational therapy and education literature sources were also included. This was decided because the population of interest identified using the PICO method within the problem identification stage, included occupational therapy and school-based education.

Upon completion of the pilot, a specific inclusion criterion was created to only include occupational therapy literature (exceptions are discussed in the inclusion/exclusion section). This was deemed appropriate because the pilot search had identified an abundance (N>90) of occupational therapy literature sources on handwriting. In addition, the decision to concentrate the literature sources to include only occupational therapy sources was made because this fit the defined focus of the research questions guiding the

integrative review. Furthermore, the clinical utility of the occupational justice framework for guiding an integrative review methodology was unknown. Testing the framework on the literature sources from one profession may increase the feasibility of summarizing the findings into an integrative review format.

3.3.3 Databases

The databases were chosen to provide a comprehensive review of the literature that aligned with the specific variables of interest: handwriting, occupational therapists, and occupational justice. Maximizing the possibility of obtaining diverse literature sources would maintain the integrity of the outcomes of the integrative review. The databases searched were limited to those that were most likely to include literature sources that related to occupational therapy and handwriting.

The electronic databases chosen were: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Cirrie, Campbell Collaboration, EMBASE, Educational Resources Information Center (ERIC), OT Seeker, and PubMed. The search engines: Prowler; which allows multiple databases to be searched at once, Google, and Google Scholar were included to increase the probability of obtaining a larger proportion of eligible sources. The integral difference between the search engines is that Prowler searches databases while Google and Google Scholar search the World Wide Web. It was anticipated that by including both types of search engines, a larger variety of literature sources might be collected. Google and Google Scholar were used to collect Canadian grey literature on handwriting practices in occupational therapy and education, specifically, national and provincial: policies, position statements, guidelines, values, and curricula.

3.3.4 Additional Search Strategies

Additional search strategies were also included in the methodology. In acknowledgement that computerized databases are efficient and effective, there are known limitations in only using computerized databases. Limitations such as inconsistent search terminology and indexing problems may result in computerized databases identifying approximately

50% of the eligible studies (Whittemore & Knafl, 2005). To address these limitations, additional search strategies were employed, including journal hand searching: (1) the reference lists of all obtained sources (ancestry search), (2) personal library collection (2005-2010), (3) indexes of: the Canadian Journal of Occupational Therapy (CJOT), OT Now, American Journal of Occupational Therapy (AJOT) and the World Federation of Occupational Therapists Bulletin (WFOT Bulletin) (2005-2010).

To identify additional sources using the hand search methodology, the indexes (titles of articles) of the specified publications and library collection, and the references lists of the obtained sources were hand searched for the search terms and the terms/variables established as a result of using the PICO method.

3.3.5 Literature Search Process

An instructional services librarian from Dalhousie's Kellogg Library was hired to complete the mechanical aspect of searching the databases/literature. Her experience and administrative authorization guaranteed an extensive scope of literature to be gathered in a reduced time frame. The research librarian used the research search terms and the databases as instructed by the author. A web-based, commercial citation manager (Refworks) was used to manage the citations.

3.4 Inclusion And Exclusion Criteria

Once the literature sources were obtained based on the search strategies described previously, sources were examined using predetermined inclusion/exclusion criteria. The inclusion/exclusion criteria reflected the objective of the integrative review, which was to obtain recent literature that would provide a comprehensive understanding of the occupation of handwriting and would identify the factors impacting handwriting practices from an occupational justice perspective. The inclusion and exclusion criteria of the integrative review were organized into a decision tree for methodological rigour (see Appendix E).

The criteria for inclusion into this integrative review were that: (1) the literature source was published during 1995-2010. This decision was based on Graham and Weintraub's (1996) review. Graham and Weintraub included fifteen years of literature sources previous to the time of their 1996 literature review publication. Because it had also been fifteen years since Graham and Weintraub's publication, this time frame of fifteen years, was established for this review; (2) the literature source focused on the occupation of handwriting. This was to ensure only the sources that contributed to the comprehensive understanding of the occupation of handwriting were included; (3) the literature source was based upon the pediatric population (0-14years of age) because this is the stage when handwriting development occurs and is introduced in the education system; (4) the literature source was published in the English language or translated into the English language for reading comprehension; (5) the literature source's participants (or author if no participants) were from a country which recognized, as of January 2010, English as an official language or de facto official language. The intention was to collect English sources detailing handwriting practices similar to that employed in Canada; (6) the encoded characters explored in the literature source was based upon the Basic Modern Latin Alphabet. This was to ensure that the alphabet (referred to as encoded characters) described or used was akin to the alphabet used in Canada, which includes 26 letters, in both upper and lower case form, printed from left to right; (7) the authors of the literature source were occupational therapists or the content of the literature source was on occupational therapy (see exceptions detailed in Appendix E). The intention was to ensure that the literature source had a specific occupational therapy focus.

The exclusion criteria were also predetermined (see Appendix F). The criteria for exclusion from the integrative review were that: (1) the source did not meet the inclusion criteria; (2) the grey literature identified was from a country other than Canada; (3) the source was of a particular publication type including: unpublished work, magazine, catalog, handwriting program endorsement, newsletter, newspaper article, book, textbook, masters/doctorial thesis or quantitative literature review article. It was from these predetermined criteria that the literature sources were evaluated.

3.5 Identifying Relevant Literature Sources- Evaluation

Following the search and identification of relevant literature sources based on the predetermined inclusion and exclusion criteria, the full text sources were obtained and categorized based on the publication type and the factors identified within the Framework of Occupational Justice.

As described earlier within the methods chapter, a diverse sampling frame was established to identify relevant literature sources from both empirical studies and theoretical sources. This type of sampling frame increased the complexity of the data evaluation process due to the diversity in the literature sources obtained (Whittemore & Knafl, 2005). As a result, quality criteria instruments were developed for the purposes of this review, to ensure consistent literature evaluation. The next sections reviewed the process of categorizing and evaluating the literature sources obtained.

3.5.1 Categorizing The Literature Sources

The full text sources that met the inclusion criteria, were reviewed and categorized with two labels: (1) *Publication Type/Design Characteristic* (2) *Factor/Characteristic Type*.

The first label, *Publication Type/Design Characteristic,* described the type of literature source (see Appendix G). The five Publication Type/Design Characteristics included: Quantitative sources, Psychometric Analysis Sources, Qualitative Sources, Mixed Methods Sources, and Alternative Sources. Each literature source was categorized as one *Publication Type/Design Characteristic.*

The Alternative Source is a category for literature sources which could not be categorized as qualitative or quantitative studies. Alternative literature sources included: persuasive or descriptive papers, critical analysis, lectures or presentations, policies, values, position statements, and guidelines.

The second label, *Factor/Characteristic Type,* was based on the terms and the previously defined definitions from the Framework of Occupational Justice to categorize the literature source. The factors from the Framework of Occupational Justice were established as predetermined conceptual categorizations for the literature sources to compare and present the data. Each literature source was categorized as a *Factor/Characteristic Type,* particularly Structural and Contextual Factors, based on the title, purpose/objective, and the introduction of the literature source. These sections were reviewed for information that could be described as a factor from the Framework of Occupational Justice. It was thought that each literature source would be categorized as one *Factor/ Characteristic Type*. However, because of the complex nature of handwriting, the diversity of the literature sources obtained, and the method for categorizing the factor type (analyzing the title, introduction and the purpose/objective) this resulted in the numerous factor types being identified. Therefore, the initial decision was changed to allow each literature source to be categorized as multiple *Factor/Characteristic types*.

In addition, descriptive words derived from the literature sources were identified and recorded. The descriptors were derived from the content of the literature source and were considered a synopsis of the topics discussed within the source. For example, in the literature review section, if the development of grasp was described and the various classifications used to describe grasp patterns were included, than "grasp" was recorded as a descriptive word. Alternatively, if in the methods section, an outcome measure was described, such as the ETCH-C, than "ETCH-C" was recorded as a descriptive word. There were no limits to how many descriptive words may be used to describe the content of each literature source. Upon completion of categorizing the literature sources, the descriptive words from each literature source were compiled and became the sub-factor categorizations. These sub-factor categorizations were not predetermined; they were derived based on the content of the information within the literature sources.

3.5.2 Evaluating The Literature Sources Using The *Grade System*

The diverse literature sources obtained were evaluated based on a three-stage quality rating strategy termed the *Grade System,* which was created for the purposes of this integrative review. The *Grade System* included two tools: *Publication Questionnaire (PQ) and URDC Evaluation Tool*. Together, these two tools provided the third quality rating in the *Grade System* termed the *Final Grade* (see Appendices H, I, J, K, L). The *Grade System* also provided a second layer to the inclusion/exclusion criteria because a minimum score within the *Grade System* had to be met in order to be included into the integrated review. A decision tree has been created to graphically depict the *Grade System* (see Appendix M).

3.5.2.1 Grade System: Publication Questionnaire (PQ)

The first stage of evaluating each literature source using the *Grade System* was to determine which *Publication Questionnaire* was the appropriate one to use (see Appendices H, I, J, K, L). This was based on the *Publication Type/Design Characteristics* type used to categorize the literature source. For example, a source categorized as a "quantitative" *Publication Type/Design Characteristic*, the *Publication Questionnaire: Quantitative Sources* would be used (see Appendix H). The *Publication Questionnaires* were used as a methodological system for evaluating the literature source and for deciding whether to include or exclude the source based on the quality of the material presented (see Appendix M).

The *Publication Questionnaires* were modified versions of previously published critical reviews (see Table 3.1). The original questions were modified slightly for the purposes of this integrative review, to illicit a positive "yes" response. The guidelines for the previously published critical reviews were used to maintain fidelity and to provide a consistent and equitable process for responding to the yes/no questions. Each of the *Publication Questionnaires* had a different denominator or total of yes or no questions. Therefore, for each *Publication Questionnaire*, all of the yes responses were summed to provide a raw score. This raw score was used as an additional layer of the inclusion/exclusion criteria. Literature sources that had a total sum equal to or greater

than fifty percent (# yes answers/number of total questions) on the *Publication Questionnaire* would be included; those with less than fifty percent would be excluded.

Table 3.1 The *Publication Questionnaires* developed for the purposes of this review were based on the previously published critical appraisals identified.

Publication Questionnaire	**Original, Previously Published Critical Appraisal**
Publication Questionnaire: Quantitative Sources	*"Guidelines for Critical Review Forms-Quantitative Studies"* *"Critical Review Form- Quantitative Studies* Law, M., Stewart, D., Pollock, N., Letts, L., Bosch, J., & Westmorland, M. (1998)
Publication Questionnaire: Psychometric Analysis Sources	*Critical Appraisal of Study Design For Psychometric Articles Evaluation Form* MacDermid, (2007), published in Law, M., & McDermid. J. *Evidence-Based Rehabilitation, A Guide to Practice.*
Publication Questionnaire: Qualitative Sources	*"Guidelines for Critical Review Forms- Qualitative Studies* (Version 2.0)*"* *"Critical Review Form- Qualitative Studies* (Version 2.0)*"* Letts, L., Wilkins, S., Law, M., Stewart, D., Bosch, J., & Westmorland, M. (2007)
Publication Questionnaire: Mixed Methods Sources	*"Guidelines for Critical Review Forms-Quantitative Studies"* *"Critical Review Form- Quantitative Studies* Law, M., Stewart, D., Pollock, N., Letts, L., Bosch, J., & Westmorland, M. (1998) *"Guidelines for Critical Review Forms- Qualitative Studies* (Version 2.0)*"* *"Critical Review Form- Qualitative Studies* (Version 2.0)*"* Letts, L., Wilkins, S., Law, M., Stewart, D., Bosch, J., & Westmorland, M. (2007)
Publication Questionnaire: Alternative Sources	*Critically Analyzing Information Sources* Cornell University Library [Retrieved 2011/Jan/30]

3.5.2.2 Grade System: URDC Evaluation Tool

The second stage of evaluating the quality of the literature sources used the *URDC Evaluation Tool* (see Appendices H, I, J, K, L). The *URDC Evaluation Tool* evaluates three components: utility, relevance, and design or content. Each literature source may receive one point for each component (see Appendix M).

A literature sources is described as "utilizable" if a wide group of occupational therapists or teachers in primary education may use the information presented in the literature source to some extent (either be influenced by or implement a specific process, intervention, etc.). A literature source was described as "relevant" if it has a direct connection or significance to the objective of the integrative review: occupational justice and or handwriting practices. When the information within the literature source was determined to be of high utility, it was given 1 point. If it was determined to be of high relevance, it was given 1 point. Otherwise, the literature sources were given zero points for low utility and low relevance. The utility and relevance scores were based on personal opinion and clinical experience.

The *Publication Questionnaires* previously described, were used to determine the design/content score on the *URDC Evaluation Tool*. The design/content scores were measures of methodological, theoretical or content rigour, depending on the type of publication. For this evaluation process, the raw score from the *Publication Questionnaire* was calculated into a percentage (# yes answers/number of total questions). A *Publication Questionnaire* score of 75% or more was defined as high design or content rigour and was given 1 point. Low design or content rigour was defined as of 50-74% and was given zero points. Using the *URDC Evaluation Tool* in this manner enabled the multiple publication types to be evaluated equally regardless of the methodologies employed.

3.5.2.3 Grade System: Final Grade

The final stage of evaluating the literature sources for quality using the Grade System was to determine the *Final Grade* (see Appendices H, I, J, K, L). The *Final Grade* was made

up of the three individual scores from the three components: utility, relevance and design/ content (see Appendix M). A Final Grade of 3/3 or 2/3, or a Final Grade of 1/3 for utility or relevance was considered appropriate for the inclusion into the review. However, a Final Grade of 1/3, where the one point was given for design or content, the source was excluded from the review. This was decided because if the literature source was not considered to have high utility and relevance, the information within the source was not appropriate to include regardless of how rigourous the design or content was found to be.

3.5.3 Data Management

Detailed records were maintained in a hardcopy and an electronic copy format. Manual coding on the hardcopy sources was conducted for reassurance in case of computer failure. The categorization of the literature sources including the descriptive words, the inclusion/exclusion status, and the reasons for exclusion were manually coded on a master reference list, again for reassurances, efficient data retrieval, and to ensure the search history was recorded. A database of the included literature sources made from an excel spreadsheet was also created and included the categorizations, descriptive words, and criteria from the critical review forms. Additional descriptive and supportive data were also extracted and integrated into this database. Decision trees were created and employed, as previously described. Lastly, manual records of decisions, hunches, and thoughts were maintained for efficiency and fidelity.

3.6 Summary

An overview of the complexity of the integrative review methodology that is inherent with a diverse sampling frame has been provided. The literature search methodology included: the search terms “handwriting”, “occupational therapy” “school-based occupational therapy” and “curriculum”. A pilot of the search methodology was completed. Literature sources were categorized based on the type of publication and the factors from the framework of occupational justice. Literature sources were evaluated based on a quality rating strategy, the *Grade System*, which was created for purposes of

this integrative review. The *Grade System* included the *Publication Questionnaires*, *URDC Evaluation Tools,* and the *Final Grade*. The next chapter describes the appraisal of the included literature.

CHAPTER 4 APPRAISAL OF THE INCLUDED LITERATURE

4.1 Literature Search Strategy

A thorough search was completed using the electronic databases: CINAHL, EMBASE, ERIC, PubMed, and Prowler (1995 to November 15, 2010), and Cirrie, Campbell Collaboration, and OT Seeker (1995 to January 9, 2011). The Canadian grey literature was searched including (1) Google Canada and Google Scholar (the first ten pages with ten results per page, January 9, 2011). The search terms were limited to: handwriting, handwrit*, occupational therapy, school-based, and curriculum.

As a result of the Canadian grey literature search, thirteen Departments of Education websites across Canada, twelve Canadian Provincial/Territorial Professional Occupational Therapy Organizations websites, ten Provincial Regulatory Organizations of Occupational Therapy websites, and one National Association website for Occupational Therapy were identified. The identified websites for both education and occupational therapy were individually searched because each website was formatted differently. In addition, not every website included a search-terms box. Therefore, a manual search for the search terms within each website was completed. Four occupational therapy organizations were email addresses instead of organizational websites; because of this, these four organizations were excluded from the literature search.

The Departments of Education websites were searched first. The search terms were limited to: handwriting, handwrit*, occupational therapy, school-based, and curriculum. If the provincial website had a search-terms box, the search terms were inputted. However, when a search-terms box was not located on the website, manual searches for the search terms within the website were conducted. The search term “curriculum” typically resulted in a link to a curriculum page within the Department of Education website. The English Language Arts curricula were searched for information on handwriting practices.

A majority of the provincial Departments of Education websites identified a *Common Curriculum* existed. The *Common Curriculum* was the result of a joint effort by a specific group of provinces, to provide a consistent curriculum across jurisdictions. Two English Language Arts common curricula were identified. The Western & Northern Canadian Protocol (WNCP) developed the first common curriculum identified. The WNCP included the provinces: Alberta, British Columbia, Manitoba, Northwest Territories, Saskatchewan, Yukon, and Nunavut. The second common curriculum identified, was developed by Atlantic Canada and included the provinces: New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island. The provinces within these two common curricula were assumed to have similar, if not identical English Language Arts curricula expectations for handwriting outcomes because these provinces were part of one of the two collaborative approaches, to create a curriculum.

It was identified that each Department of Education presented the English Language Arts curriculum differently, even if a common curriculum was used. Some departments divided the curricula by grade. Therefore, the curricula for Kindergarten to Grade 4 were searched (1995 to December 30, 2010). Some websites divided the English Language Arts Curriculum by academic outcomes. Therefore, the outcomes for "writing" were searched. Additionally, within each of these two presentation formats, the curriculum outcomes also existed in different documentation formats even when a common curriculum was used. Increased effort to identify the search terms, maintain the search strategy, and maintain fidelity was made.

As a result of the literature search conducted within the English Language Arts curricula, it was identified that modifications to the search terms were required. This was because the terminology used within the provincial Departments of Education were not found to be complementary to the terms used within this research study. Many curriculum outcomes for handwriting were found, but different terms were used to describe handwriting. Therefore with regards to the Canadian grey literature on education, specifically within the Departments of Education, the search terms were modified to: writ*, text, conventions, graphophonics, presentation and legibility. The modification to

the search terms resulted in thirteen curriculum outcomes on handwriting being identified, which were obtained for evaluation using the predetermined inclusion/exclusion criteria.

The identified occupational therapy organizational websites were also searched using the search terms: handwriting, handwrit*, occupational therapy, school-based, and curriculum. If the website had a search-term box, the search terms were inputted. However when a search-term box was not located within the website, manual searches for the search terms were searched within: professional standards, practice guidelines, resources, documents, position statements, and pediatric positions papers (1995 to December 30, 2010).

Similar to the Department of Education search strategy, modifications to the search terms were required because literature sources on handwriting were not identified using the original search terms. Therefore, the search terms: pediatric, children, and policies were also searched. The modified search resulted in four literature sources, which were obtained for evaluation using the predetermined inclusion/exclusion criteria.

Finally, the three mechanical searches were conducted as planned. This included hand searching: the reference lists of all obtained sources, personal collections of sources (2005 to December 30, 2010), as well as an index search was completed with the Canadian Journal of Occupational Therapy, OT Now, American Journal of Occupational Therapy and the World Federation of Occupational Therapists Bulletin (2005 to December, 2010). This resulted in literature sources that were not identified using the electronic databases or search engines, being identified using this method.

As a result of the search strategy, two hundred and twenty six literature sources published between 1995-2010 were identified. The sources were evaluated for inclusion/exclusion criteria. A summary of this evaluation has been provided in a flow chart, which graphically depicts this process (see Appendix N).

Of the two hundred and twenty six literature sources, thirty-eight were excluded because the focus of the source was not on handwriting. Two of these excluded sources did have the term writ* in the abstract, however the context in which the term was used within the two sources, did not refer to the pediatric occupation of handwriting. For example, the sources included the phrases: "written surveys" (Case-Smith & Cable, 1996) and "document was written [for the purpose of]" (Clark, Polichino, & Jackson, 2004). It is also important to note, the pediatric occupation of handwriting may have been referred to within the body of the thirty-eight, excluded literature sources. However, these sources were excluded because the title, abstract or keywords did not include the term writ* or handwrit*. Additionally, within these thirty-eight, excluded literature sources, four, were obtained from the occupational therapy organization websites. These literature sources contained information on occupational therapy position statements and guidelines but were excluded because "writ*" was not identified within the title, keywords, or abstract.

Subsequently, two literature sources were excluded because the age of the identified population included older teenagers (16 and 17 year olds) or adults, not pediatrics (ages 0-14). Following this, thirty-seven literature sources were excluded because the author(s) conducted the research within a country, which did not recognize English as an official, or de facto official language, or the country does not use the Basic Modern Latin Alphabet. Twenty-six of these thirty-seven, excluded literature sources, were authored by an occupational therapist from the following countries: Israel, Ireland, Taiwan, China and the Netherlands. In addition, one literature source detailing the handwriting curriculum outcomes identified within a Department of Education website was excluded because it was written in French and a translated version was not identified (Quebec).

The remaining, one hundred and forty-nine literature sources were evaluated to determine if there was an occupational therapist on the author list. Every author's credentials were searched on Google if the credentials were not documented within the literature source. A majority of the literature sources gathered from the Departments of Education did not indicate authorship. Therefore, twelve Departments of Education, were emailed to identify if an occupational therapist was on the author list of the handwriting curricula

obtained. Seven of the provincial Departments of Education responded. It was identified that no occupational therapist participated in the development of the curricula on handwriting. Two of these Departments of Education reported that although an occupational therapist was not on the authorship list, the curricula were current and research-based (Saskatchewan & Ontario). As a result, all of the literature sources detailing the handwriting curricula were excluded. This was based on the knowledge that the two common curricula on English Language Arts included eleven out of the thirteen Canadian provinces and territories. The responses from seven representatives of the Departments of Education indicated that all known curriculum outcomes on handwriting were not developed in consultation with an occupational therapist. Therefore, because of the identified connection of the Departments of Education to the common curricula, it was assumed that the other five departments that did not respond to the email had a high probability of not consulting with an occupational therapist. Out of the 149 literature sources, a total of fifty-two literature sources were excluded because an occupational therapist was not the primary author and the source did not meet the exception to the occupational therapy authorship criteria detailed in the inclusion/exclusion criteria.

Lastly, twenty-two literature sources were excluded. Eighteen of these literature sources were excluded for source type (i.e. quantitative literature review, thesis, magazine, or catalog, etc). Four of these literature sources were unable to be obtained in original or complete format. The original author of the literature source, which could not be obtained in complete format, was contacted via email, but no response was returned.

In summary, based on the literature search strategy and inclusion/exclusion criteria, a total of seventy-five literature sources were included. The results of evaluating the identified relevant literature sources were described in the next section.

4.2 IDENTIFYING RELEVANT LITERATURE SOURCES-EVALUATION

The results of the seventy-five literature sources categorized based on the *Publication Type/Design Characteristic,* the *Factor/Characteristic Type,* and evaluated based on the *Grade System,* were described in the following sections.

4.2.1 Categorizing The Literature Sources: Publication Type/Design Characteristic

The seventy-five literature sources were obtained in full text format and categorized based on the *Publication Type/Design Characteristic* as previously described (see Appendix G). A summary of the results of the publication types were provided (see Figure 4.5). Forty-nine of the literature sources obtained were categorized as Quantitative Publication Types. Twenty literature sources were categorized as Alternative Publication Types. Five literature sources were categorized as psychometric analysis. Only one literature source was categorized as a Mixed Methods Publication Type (Addy, 1996). This research study used an illuminative design, which the author described as a methodology that allowed both quantitative and qualitative evidence to be collected and allowed them to "view the problem from a number of angles" (Addy, 1996, p. 429). Out of the seventy-five articles obtained, not one literature source from the occupational therapy literature on handwriting was classified as Qualitative. It is also worthy of note, only two of the forty-nine quantitative publication types were randomized controlled trials (Denton, Cope, & Moser, 2006; Zwicker & Hadwin, 2009) and one literature source was identified as a quasi-randomized controlled trial (Sudsawad, Trombly, Henderson & Tickle-Degnen, 2002). The next section revealed the results of the *Factor/Characteristic Type* and the theoretical limitation that occurred as a consequence of categorizing the factor types.

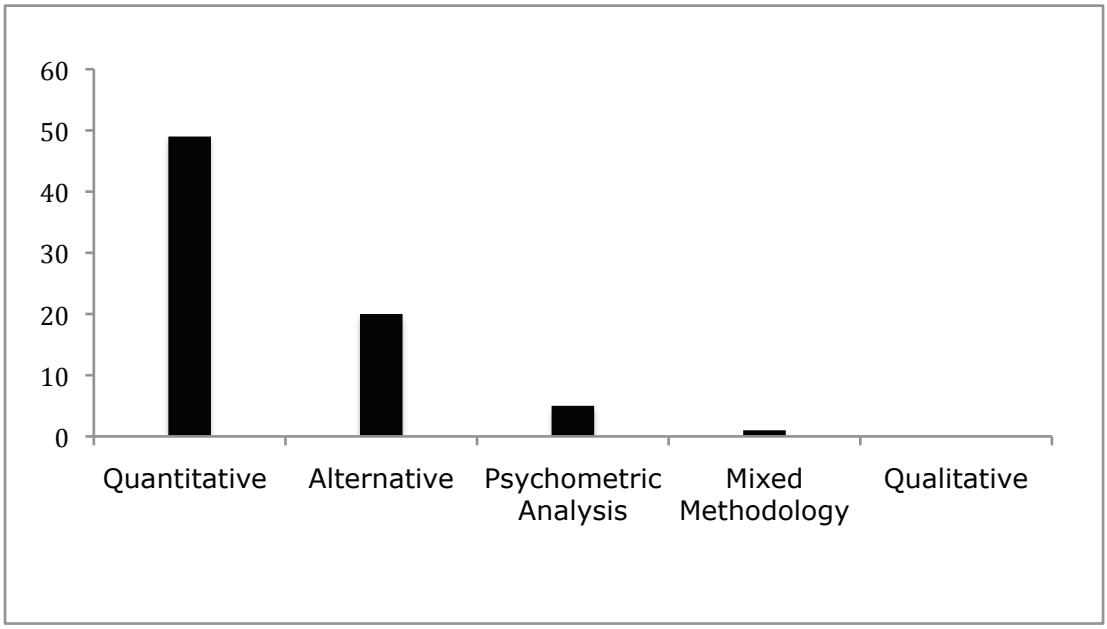

Figure 4.5 The distribution of the publication types included in the integrative review

4.2.2 Categorizing The Literature Sources: Factor/Characteristic Type

Following the categorization of the seventy-five literature sources based on the *Publication Type/Design Characteristic*, the sources were categorized based on the *Factor/Characteristic Type*. The title, purpose/objective and the introduction of the literature sources were reviewed. The information gathered from the literature sources was primarily found to describe the occupation of handwriting and the resulting interactions, not the structural or contextual factors. This limitation was addressed before the literature sources were categorized based on the factor type. The theoretical limitation and solution were described in detail in the following sections.

4.2.2.1 Factor/Characteristic Type: Theoretical Limitation

The Framework of Occupational Justice, as initially envisioned and described by Townsend & Wilcock (2004b), and later revised by Stadnyk (2007, 2010), illustrates a critical perspective process for identifying the structural and contextual factors that contribute to conditions of an occupational justice or injustice. The framework is based on a developed world, democratic practice context. Even though, the framework formed the theoretical underpinning of this integrative review, four limitations were encountered

when attempting to practically use the framework to categorize the occupational therapy literature on handwriting. As a result, alterations were made to the framework based on the findings from the obtained literature sources collected and the peculiarities of the occupation of handwriting.

The four limitations to the framework were as described. Firstly, although the Framework of Occupational Justice (Stadnyk, 2010) was created as an exploratory process of justice or injustice in *occupations*, there is no explicit, graphic representation of the occupation illustrated in the framework. In addition, the interactions between the structural and contextual factors and the occupation were also not illustrated in the framework. These two omissions became particularly relevant when conducting the proposed integrative review. Evaluating the obtained occupational therapy literature sources on handwriting led to the identification that the information within all seventy-five of the literature sources focused solely on the *occupation* of handwriting and the resulting *interactions*. As well, within the current framework, the unidirectional arrow illustrates a linear process from the structural to contextual factors to the occupational outcomes. However, in this integrative review, it was assumed there was an occupational injustice prior to the commencement of the study. Therefore, the study was essentially working "backwards" through the framework to identify the factors from the literature sources, which were contributing to the occupational injustice. Lastly, the current framework may be used to describe many occupations that simultaneously contribute to conditions of an occupational justice or injustice. In some circumstances, the information obtained from the occupational therapy literature sources on handwriting, particularly the information categorized as structural or contextual factors may have been applied to many occupations. Occupations, such as fine motor skills, in-hand manipulation, were also identified within the handwriting literature sources collected. However, for the purposes of this integrative review, only one occupation was identified and explored: the occupation of handwriting.

Therefore, to accommodate these findings, the *Revised Framework of Occupational Justice* was developed. This revised framework included two additional categories, (1)

Occupation Factors for the occupation, and (2) *Occupational Interactions* for the identified interactions between the structural and contextual factors and the occupation. A third category was also included (3) *Identify the Occupation,* to explicitly state the occupation. (4) Lastly, the *Exploratory Process of Justice,* a bi-directional arrow was included.

As previously mentioned, the need for revising the framework and creating additional factors and features were a result of the limitations in the current framework. These limitations resulted in the current framework not representing the information found within the literature sources effectively or comprehensively. The alternative was to force the information identified from within the literature sources into the two original *Factor/Characteristic Types: Structural* or *Contextual Factors*. However, this was thought to not be an appropriate alternative because *Structural Factors* are considered to describe the *where, when, with whom* and *how,* and the *Contextual Factors* describe the individual, social, or cultural characteristics. Whereas, the information gathered from the literature sources was reflective of the *occupation* and the *occupational interactions*. Therefore, it was thought that by adding the O*ccupation Factors,* this component allowed the occupation or the *what* to be represented, while adding the *Occupational Interactions* component allowed the *connections* to be represented separate from the structural and contextual factors. Furthermore, by adding a bi-directional arrow, this illustrated that the process of evaluating the occupational justice or injustice may start at any component (factor, interaction or outcome). Whereas, the addition of *Identify the Occupation* allowed the author using the revised framework to explicitly state and clarify the occupation of concern for the reader. By including these additional components and features to the revised framework, it was believed that the integrative review was better positioned to describe and present the information gathered from the collected literature sources. It is also suggested that because of these modifications, a more comprehensive critical perspective of handwriting may be obtained. The next section detailed the *Revised Framework of Occupational Justice* created as a result of the findings within the literature sources.

4.2.2.2 The Revised Framework Of Occupational Justice

The *Revised Framework of Occupational Justice* was developed and used to categorize the literature sources in this integrative review, due to the challenges identified and the reasoning described in the previous section. Visual representations of the *Revised Framework of Occupational Justice* are presented in Figures 4.6 and 4.7. This revised framework transformed the current framework by creating two new components: *Occupation Factors* and *Occupation Interactions*, and adding two new features: the *Exploratory Process of Justice* and *Identify the Occupation*.

The *Revised Framework of Occupational Justice* is envisioned as one model although it is illustrated as two. The two figures were provided for a comprehensive, visual understanding of how the conditions may lead to an occupational justice or injustice. In Figure 4.6, the conditions lead to an occupational justice. This is represented by darkened rectangles, analogous to a bridge, which promotes the interaction of the structural and contextual factors with the occupation. Alternatively, conditions may lead to an occupational injustice, which is illustrated by the clear rectangles in Figure 4.7. The clear rectangles are analogous to the lack of a bridge, thus restricting the interaction between the structural and/or contextual factors with the occupation.

In the component *Identify the Occupation,* the occupation or occupations are stated explicitly. This is important to clarify prior to exploring the factors within the revised framework of occupational justice to give context to the information presented. Particularly when, the information gathered from the literature sources and presented within the structural or contextual factors may be applied to many occupation. Or when, occupations, other than the occupation of interest, may also be described or identified within literature sources collected. Therefore this component ensures that the occupation of concern is explicitly stated to provide the reader with a context for the information provided.

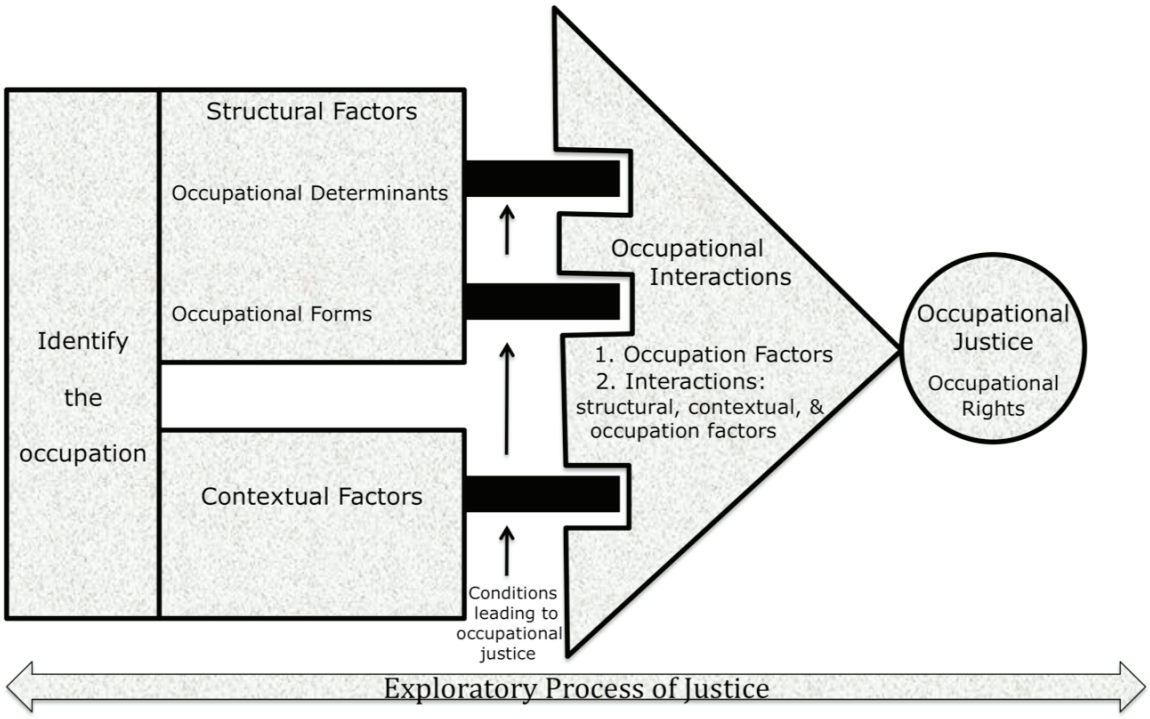

Figure 4.6 The *Revised Framework of Occupational Justice*; a visual representing an occupational justice.

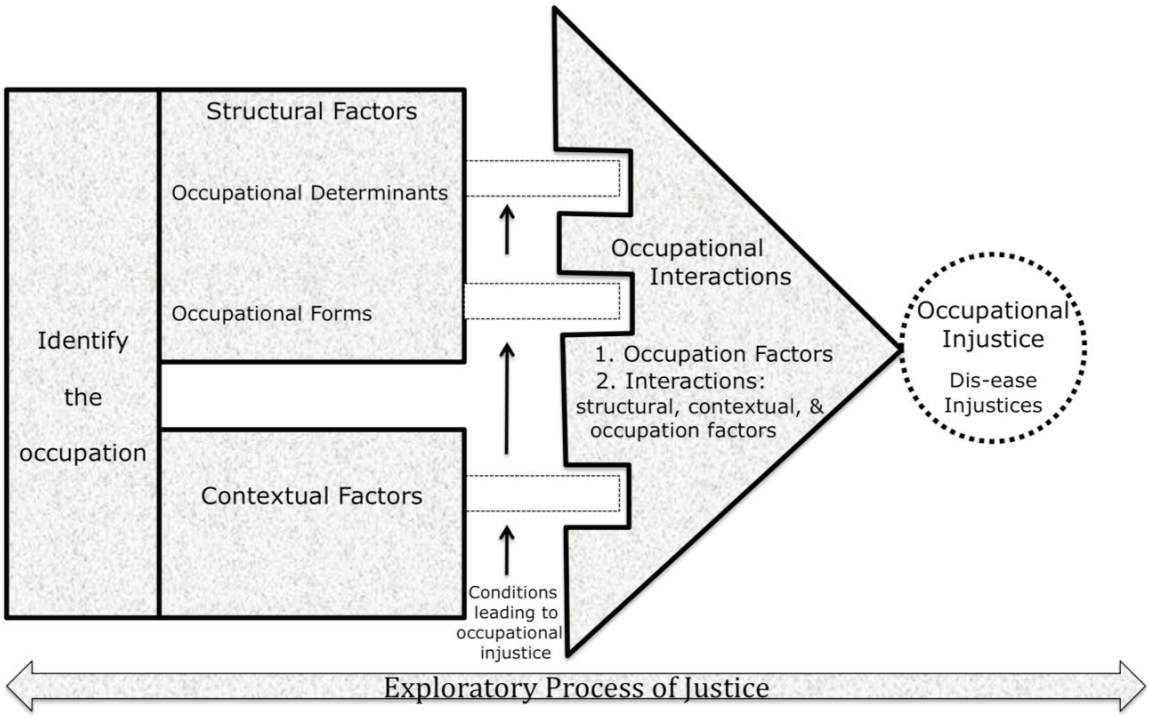

Figure 4.7 The *Revised Framework of Occupational Justice*; a visual representing an occupational injustice.

The *Exploratory Process of Justice,* depicted by the long, bi-directional arrow, encompassing the full length of the revised framework, illustrates that the process may start at any component (factor, interaction or outcome) and may be dependent on the perspective used to describe the occupational justice situation. As an example, if a research perspective is used, the author would hypothesize the occupational outcome (occupational justice or injustice), than the factors contributing to conditions of justice would be searched within the research literature. Alternatively, from an individual, community or nation's perspective, the individual might describe structural or contextual factors he/she is experiencing, than the conditions contributing to the occupational outcome: occupational justice or injustice outcome, may be identified. This illustrates that depending on the perspective the process of exploring justice may start at any component. Lastly, the bi-directional arrow encompassing the full length of the revised framework, illustrates that in order to accurately identify and describe the occupational outcome, either occupational justice or occupational injustice, the whole framework; factors and features, must be explored and described, regardless of where the process started.

In the revised framework, the *Structural Factors*: *occupational determinants* and *occupational forms*, and the *Contextual Factors* continue to be defined and described as in the original framework by Stadnyk (2007, 2010). Therefore, in this integrated review the *occupational determinants* would include literature sources such as the: policies, position statements, and values, which the occupational forms are guided by. The vision statements or guidelines of occupational therapy professional organizations and/or regulatory bodies are examples of *occupational determinants*. The *occupational forms* are the programs, services or instruments. For example, school-based occupational therapy is an *occupational form*. Whereas, the *contextual factors* would include literature sources describing: the individual's biological, social and cultural characteristics. For example, a child may have a diagnosis of Developmental Coordination Disorder. The literature sources, which describe the characteristics or symptoms specific to this diagnosis, would be included within this contextual factor.

A previously mentioned, the rectangles in Figures 4.6 and 4.7 represent the conditions contributing to occupational justice or occupational injustice. The conditions leading to an occupational justice are represented by darkened rectangles, analogous to a bridge, which promotes the occupational interaction of the structural and contextual factors with the occupation factors. The conditions leading to an occupational injustice are represented by clear rectangles. This indicates that a structural or contextual factor or both (wherever the clear rectangle(s) may be) led to the conditions of occupational injustice by barring, confining, restricting, segregating, prohibiting, disrupting, alienating, marginalizing, exploiting, or excluding the interactions of the occupation (Townsend, 2003).

The two rectangles connect the *Structural Factors* to the *Occupational Interactions*. This illustrates that either one, *occupational determinants* and/or *occupational forms* may interact with the *Occupation Factors* to contribute to conditions of occupational justice or injustice. Similarly there is one rectangle connecting the *Contextual Factor* to the *Occupational Interactions*. This illustrates that an interaction between the *Contextual Factor* and *Occupation Factors* may also contribute to conditions of occupational justice or injustice. In addition, *Occupational Interactions* occurring between the *Structural, Contextual* and the *Occupation Factors* may also lead to conditions of occupational justice or injustice.

Occupation Factors, a term created for the purpose of this integrative review, describes the occupation, specifically the characteristics and components unique to the occupation. This includes the performance areas, functional components, and performance components of the occupation. For example, handwriting is the occupation. Copying is a performance area of handwriting. Legibility is a functional component, whereas motor coordination is a performance component of handwriting. Together, these features make up the *Occupation Factors.* In this integrated review, literature sources were categorized as *Occupation Factors* if the features unique to the occupation were described within the source.

Occupational Interactions, a term created for the purpose of this integrative review, describes the dynamic interaction of the S*tructural* and *Contextual Factors* with the O*ccupation Factors*, resulting in a fusion. This component illustrates that numerous factors may interact with the occupation. For example, as previously illustrated, school-based occupational therapists are described as *Structural Factors: occupational forms*. However, the role that an occupational therapist performs, *specific to handwriting*, such as the assessment and treatment of handwriting, describes the *Occupational Interaction* between the OT and handwriting. Additionally, as previously illustrated, the characteristics of a child who has a diagnosis of Developmental Coordination Disorder (DCD) is described as the *Contextual Factor*. The challenges a child with DCD experiences *specific to handwriting*, such as poor legibility or decreased motor planning of letter formations, describes the *Occupational Interaction* between the child and handwriting. Lastly, the occupational therapist's (*structural factor: occupational form*) assessment and treatment of the handwriting challenges, such as the legibility and formation (*occupation factor*), a child with DCD (*contextual factor*) experiences, describes the *Occupational Interactions* between the OT, child and handwriting. In the integrated review, literature sources were categorized as an *Occupational Interaction* if an interaction between the *structural* and *contextual factors* were described within the source.

Accordingly, the limitations of the framework, and the new factors and features that have been developed as a result of the findings of the literature sources, have been described. A visual illustrating the *Revised Framework of Occupational Justice*, definitions, and examples were also provided. The next section described the results of categorizing the literature sources on the *Factor/Characteristic Types* based on the *Revised Framework of Occupational Justice.*

4.2.2.3 Factor/Characteristic Type: Theoretical Solution

The *Revised Framework of Occupational Justice* was used in the integrative review from this point on. The seventy-five occupational therapy literature sources on handwriting, were classified as a *Factor/Characteristic Type*: *Structural Factors* (occupational

determinants and occupational forms), *Contextual Factors*, *Occupation Factors* or *Occupational Interactions*, based on the title, purpose/objective and the introduction of the literature source (see Appendix G). The previously defined definitions of the factors were used to guide the decision making process.

A summary of the results of the categorizations were provided (see Figure 4.8). Each source may be categorized as more than one factor. Therefore, the total number of literature sources categorized within the four factors together, equals more than 100%. It was anticipated that both factors were identified in all of the literature sources because this study's primary objective and thus the collected literature sources focused only on the occupation of handwriting, and because an *Occupational Interaction* cannot exist without the occupation being identified. Invariably, all seventy-five sources were classified as both, *Occupation Factors* (100% of the sources) and *Occupational Interactions* (100% of the sources). Fourteen literature sources were categorized as a *Structural Factor*, *Occupational Forms* (19% of the sources); no literature sources were categorized as an *Occupational Determinant*. Lastly, fifteen literature sources were categorized as *Contextual Factors* (20%).

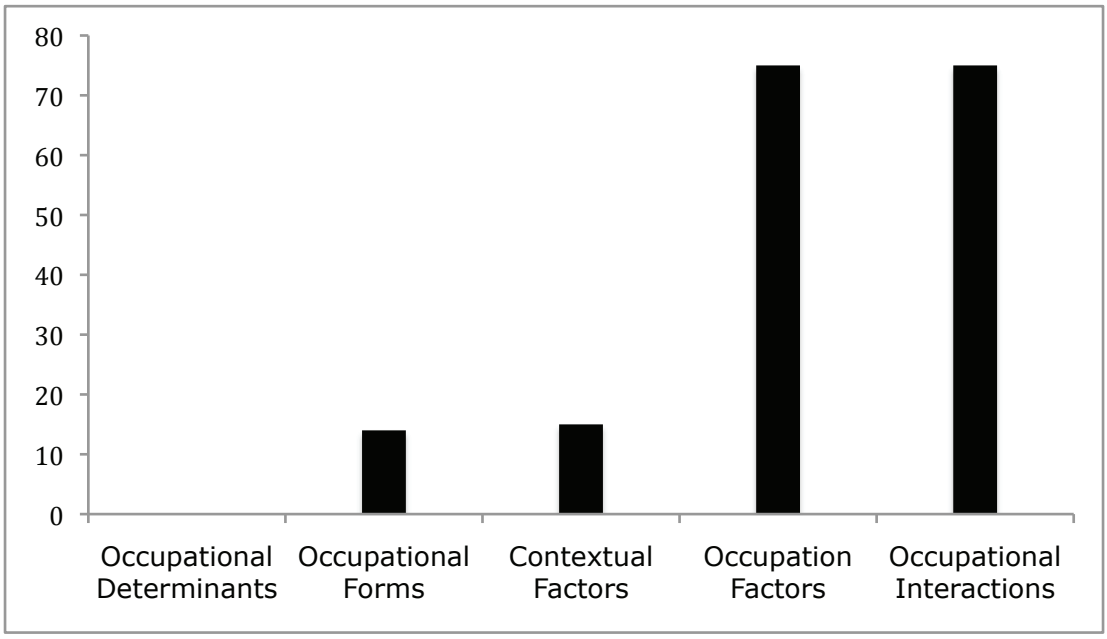

Figure 4.8 Summary of the factor types identified within the seventy-five sources

Lastly, the descriptive words obtained as a result of the content identified within the literature sources were compiled together. Themes from these descriptive words were identified. The descriptive words created the sub-factor classifications for the literature source presentation. Fourteen sub-factor classifications were identified and included: Health and Community Supports: Occupational Therapy; Technology; Ability/Disability; Ethnicity; Income/Wealth; Handwriting, An Occupational Performance; Handwriting Functional Components; Handwriting Performance Components; Children and Handwriting; Teachers and Handwriting; Teachers, Occupational Therapists, and Handwriting; Occupational Therapy and Handwriting; Occupational Therapy Assessment of Handwriting; and Occupational Therapy Treatment of Handwriting. The next section described the evaluation of literature sources based on the *Grade System*.

4.2.3 Evaluating The Literature Sources Using The Grade System

This section described the results of the evaluation of the literature sources. The evaluation was based on the three-stage, quality rating strategy developed for the purposes of this integrative review termed the *Grade System*. The *Grade System* strategy as previously described, used the two, quality assessment tools *Publication Questionnaire* and *URDC Evaluation Tool,* to obtain the *Final Grade* for each literature source. Using the *Grade System* in this manner enabled the multiple publication types to be evaluated equally.

As a result of the first stage of the evaluation, all seventy-five, literature sources obtained a score greater than 50% on the *Publication Questionnaires*. Therefore, no literature sources were excluded based on score of the *Publication Questionnaire*. In addition, all seventy-five, literature sources received at least one high utility or high relevance score. Therefore, no literature sources were excluded from the integrated review based on the *Final Grade.* A summary of the distribution of *Final Grades* was provided (see Figure 4.9). The majority of sources (80%) received a *Final Grade* of 3/3, whereas, a small fraction (16%) received a *Final Grade* of 2/3. Only a tiny minority (4%) received a *Final Grade* of 1/3.

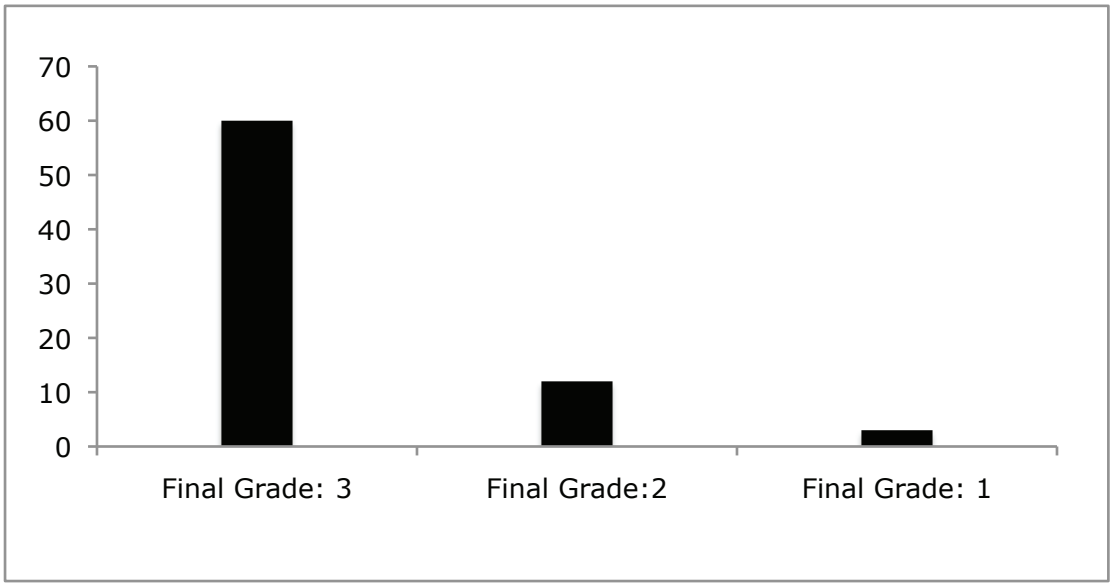

Figure 4.9 The distribution of the *Final Grades* given to the seventy-five sources

As a result of the three-stage, quality rating strategy called the *Grade System,* all seventy-five, literature sources obtained were included within the integrated review (see Appendix O for the author list of included sources). In addition, based on the distribution of the *Final Grades*, it was acknowledged that the majority of the occupational therapy literature sources included in the integrative review, were determined to be highly utilizable, highly relevant and demonstrated high design or content rigour. The next section described how the literature sources were integrated and presented.

4.3 Literature Presentation

This section described how the findings from the literature sources were presented within the integrated review. The seventy-five sources were not presented within the integrative review, based on the value of their *Final Grade*. This was because the purpose of the integrative review was to present a narrative of the occupational therapy literature as it described the factors within the *Revised Framework of Occupational Justice* relating to occupational justice or injustice, not to present a ranking of the literature findings. However, in the interest of providing transparency and thus to allow the reader to

evaluate the quality of the integrative review, a literature chart was developed and included (see Appendix Q). The literature chart described the seventy-five literature sources included within this integrative review, including the: citation, purpose, design, subjects, and *Final Grade*. In addition, because only two sources were identified to be randomized controlled trials, possible limitations within each literature source may exist. However, not all literature sources described the limitations. Therefore the literature chart also included whether the limitations were reported, not reported or not applicable. In addition, cautionary statements may have been provided when particular sources were discussed within the next chapter to highlight the reader's awareness of specific concerns found within the literature sources. Thus, the potential contributions of all the literature sources were captured, while declaring only the significant limitations.

The information found within the literature sources was integrated and presented based on the *Revised Framework of Occupational Justice*. As previously mentioned, the factors were used as the conceptual categorizations of the literature sources. Therefore, the findings presented within each section were dictated by the literature sources obtained. As a result, there were gaps within the information of some of the factor types, particularly within the *structural* and *contextual* factors. These gaps may identify an occupational injustice or may be a reflection of the search strategy employed. Thus limiting the breadth of comprehension expected regarding the occupation of handwriting and the conditions contributing to an occupational injustice. The findings from the literature sources within this integrated review were presented under the major headings: *Structural Factors, Contextual Factors, Occupation Factors* and *Occupational Interactions.* Within each major heading, the sub-factors previously described followed. A summary of the organization of each section was described.

The first section described the *Structural Factors*. Fourteen out of the seventy-five literature sources were identified to describe the *occupational forms* (see Appendix P). As previously mentioned, the *occupational forms,* describe the information within the literature sources pertaining to environmental programs and instruments. No Canadian *occupational determinants* were identified within the literature sources obtained. This

was a result of the limitations of the search methodology and the conditions leading to an occupational injustice. Two specific sub-factors were identified within *occupational forms*: Health and Community Supports and Occupational Therapy, and Technology. The literature presented in the structural factors section does not include information on the interactions between the *structural factors* and the *occupation*. That information was described within the *Occupational Interactions* section.

Following this, the next section described the *Contextual Factors*. Fifteen out of the seventy-five literature sources were identified to describe the *contextual factors* (see Appendix P). As previously mentioned, the information found within the literature sources, which related to the individuals' biological, social and cultural characteristics were described within this section. Three specific sub-factors were identified within *contextual factors*: Ability/Disability; Ethnicity; and Income/Wealth. Again, the literature presented in the contextual factors section does not include information on the interactions between the *contextual factors* and the *occupation*. That information was described within the *Occupational Interactions* section.

Subsequently, the *Occupation Factors* were described. All seventy-five, literature sources were identified to describe the *occupation factors* (see Appendices O and P). As previously mentioned, the information found within the literature sources, which related to the description and the components of the occupation were described within this section. Three sub-factors were identified within the *occupation factors*: Handwriting, An Occupational Performance; Handwriting Functional Components; Handwriting Performance Components. Again, the interaction between the *structural, contextual* and *occupation factors* were not described in this section. That information was described within the *Occupational Interactions* section.

Lastly, the final section described the *Occupational Interactions*. All seventy-five, literature sources were identified to describe the *occupational interactions* (see Appendices O and P). As previously mentioned, the literature sources that described an interaction between the *occupation factors* and the *structural* and/or *contextual factors*

were presented within this section. Six sub-factors were identified within the *occupational interactions*: Children and Handwriting; Teachers and Handwriting; Teachers, Occupational Therapists and Handwriting; Occupational Therapy and Handwriting; Occupational Therapy Assessment of Handwriting; Occupational Therapy Treatment of Handwriting. Within this section, it was observed that the complexity of the sub-factors varied from simple to complex depending on the amount of factors involved in the interaction. A majority of the findings from the occupational therapy literature sources on handwriting were integrated within this section.

4.4 Summary Of The Appraisal

This chapter reviewed the results of the appraisal of the relevant literature sources. The results of the literature search strategy and the modifications were presented. As well, the results of the literature sources categorized based on the *Publication Type/Design Characteristic*, and the *Factor/ Characteristic Type* were described. The majority of the literature sources obtained were experimental studies using quantitative methodological designs. No qualitative studies designs were identified. The information from the literature sources presented a theoretical limitation upon categorizing the literature. As a result, the *Revised Framework of Occupational Justice* was developed for the purposes of this review. Based on this revised framework, it was identified that all of the literature sources described the *occupation factors* and the *occupational interactions* between the *occupation* of handwriting and the *structural* and *contextual factors*. As a result of the three-stage quality rating strategy, termed the Grade System, the literature sources in general, were found to be highly utilizable, highly relevant literature sources with strong design/content rigor. The next chapter illustrated the findings and categorizations of the literature sources, which contributed to a better understanding of the occupation of handwriting, and the conditions leading to the occupational injustice.

CHAPTER 5 FINDINGS AND CATEGORIZATIONS OF THE INCLUDED LITERATURE

The findings from the literature sources included within this integrative review were categorized using the *Revised Framework of Occupational Justice*. The findings were organized and presented within each of the four factors from the revised framework, *Structural*, *Contextual*, *Occupation* and *Occupational Interactions*. Within each factor, sub-factors were developed as a product of the themes identified within the data collected from each literature source. Gaps within the data may be a reflection of the methodological limits used to collect the literature sources. Alternatively, the gaps may be a reflection of the conditions contributing to an occupational injustice in handwriting. The conditions contributing to an occupational injustice were described in detail within the discussion chapter. This chapter integrated and presented the findings from the seventy-five literature sources published on handwriting.

As previously mentioned, the findings presented within each of the factors *structural, contextual and occupation* were specific to the factor not the interactions. The information specific to the interactions and each factor, for example, the interaction between the *occupational forms* and the *occupational factor* were presented within the *Occupational Interactions* section. The reasoning for separating the interaction from the factors, thus creating the *Occupational Interactions*, was to highlight the importance of the information found within each factor and to illustrate that the interactions between the factors create additional information that is equally significant to emphasize.

5.1 IDENTIFY THE OCCUPATION

The occupation of handwriting was identified and analyzed within the integrated review. The information gathered from seventy-five literature sources on handwriting was incorporated. The perspective is from the occupational therapy research literature.

5.2 Structural Factors

Structural factors are made up of *occupational determinants* and *occupational forms*. *Occupational Determinants* describe the environmental structure, which include policies, regulations, rules and culture; they are reflections of the underlying economy and values (Stadnyk et al., 2010). The *Occupational Forms* are the supports or programs available within a society (Stadnyk et al.).

This section presented the information collected from the literature sources on the *structural factors*. Out of the seventy-five literature sources obtained, no literature sources were found to describe *occupational determinants* within the literature sources collected. The lack of literature sources describing *occupational determinants* may have been the result of the search methodology employed and/or may reflect the conditions contributing to the occupational injustice.

Known *occupational determinants* which would have been applicable to the study findings, were excluded based on methodological limitations in the initial search strategy. For example, as illustrated in the introduction of this integrative review, there are known literature sources that describe teachers' perspectives regarding the lack of their undergraduate educational experiences. Specifically, the teachers described their lack of education on the appropriate methods for teaching handwriting. This known finding was not included in the integrative review because educational literature was not included in the search strategy. In addition, literature sources describing the disproportionate ratio of limited occupational therapy services to the high number of children with handwriting problems are also known to exist. However, the literature was not included due to the search terms used and the predetermined inclusion/exclusion criteria. Furthermore, literature sources that describe educational policies, and teacher professional practices, are known to exist. However, based on restrictions within the predetermined search strategy, these literature sources were not included in the integrative review. Similarly, literature sources that described information on occupational therapy professional practice guidelines and position statements are known to exist. However, because of the limitations within the predetermined search strategy and the predetermined

inclusion/exclusion criteria, these literature sources were not included in the integrative review because they were not identified using the search terms or the term "writing" was not in the literature source's title, keyword or abstract, respectively.

Conversely, the absence of known literature sources, due to the methodological limitations, may provide further insight into the conditions that contribute to the outcomes of occupational injustice. For example, several known literature sources that described the curricula outcomes of handwriting were excluded from this integrative review. These literature sources were excluded because an occupational therapist was not identified as an author. The conditions contributing to an occupational injustice are explored further in the next chapter.

The information collected from these fourteen literature sources described *occupational forms* (see Appendix P). The findings from these literature sources described the sub-factors: (1) Health and Community Supports: Occupational Therapy and (2) Technology and were presented in detail in the following two sections.

5.2.1 Sub-Factor: Health And Community Supports: Occupational Therapy

Eleven literature sources contributed to the information described within this sub-factor. This sub-factor was organized into the sub-headings: Occupational Therapy Service Delivery Models; Clinical Reasoning & The Collaborative Clinical Reasoning Process; Evidence Based Practice; and Occupational Therapy Intervention. These headings were not pre-determined. They were a product of the themes identified within the information gathered.

In the literature sources collected, it was identified that occupational therapy "has categorized and defined itself as one that encompasses human performance components which serve as the basis for different occupational performance areas, within a specific set of performance contexts" (Chu, 1997, p.515). Thus, illustrating the importance of the occupational engagement within the environment. This is a well-suited role for

occupational therapy because as Bonney (1992) described, “occupational therapists possess an extensive background knowledge of neuromuscular, sensorimotor and psychological variables affecting performance, as well as the practical skills to analyze and breakdown task performance” (Daniel & Froude, 1998, p.48).

The literature sources described the well-established knowledge about the value of occupational engagement. The literature sources illustrated the profession is “not only identifying individuals but also groups of people disadvantaged through discrimination or disparity [who] are equally in need of advocacy and support” (Hocking & Whiteford; Canadian Association of Occupational Therapists, 1997; Nelson, 2000 as cited in McGarrigle & Nelson, 2006, p. 2). Suggesting that the role of an occupational therapist is not only to support occupational engagement, but to advocate for individually meaningful engagement as well. The next section, illustrated how occupational therapy is operationalized into practice.

5.2.1.1 Occupational Therapy Service Delivery Models

Five of the literature sources collected, described the service delivery models of occupational therapy. Occupational therapists work in a variety of settings, including, but not limited to: hospitals, schools (Hammerschmidt & Sudsawad, 2004; Missiuna et al., 2008) and school-based health centers (Peterson & Nelson, 2003). Within the educational setting, occupational therapy has a repertoire of three, service delivery models: consultation, direct intervention, and a combination of consultation and direct service delivery models (Dunn, 1991 & Mosey, 1993 as cited in Chu, 1997). A service delivery model is an outline of the roles and responsibilities of the employees. It is also a snapshot of how the business delivers actual services. The employer mandates which service delivery model, will be implemented (Bayona, McDougall, Tucker, Nichols, & Mandich, 2006). Whereas, the occupational therapist considers the duration and frequency of service available, academic curriculum outcomes, school policies, resources available, parent and teacher involvement along with, the model of service delivery, when providing intervention to children and how best to address their identified occupational performance issue (Chu).

A direct service delivery model is one in which the occupational therapists provides a comprehensive assessment followed by consistent, scheduled intervention, once or twice a week with minimal expected collaboration of the teacher or parent (Dunn, 1990; Sandler, 1997 as cited in Bayona et al., 2006). Alternatively, a consultation model is one where the occupational therapist completes an assessment of the child's skills and provides suggestions and strategies to the teacher or parent to support the child's functional engagement within the environment (Bayona et al. 2006). Whereas the combined model of service delivery, is the combination of the two primary service delivery models: direct and consultation (Case-Smith, 2002; King et al., 1999; McDougall et al., 1999 as cited in Bayona et al. 2006).

The identified literature sources documented, the strength of a direct service delivery model is that the therapists are awarded the ability to trial strategies, observe reactions and if required modify the intervention incidentally (Bayona et al., 2006). Alternatively, the strength of the consultation model is that it promotes conditions for collaboration between therapist, teacher and parent (Case-Smith & Cable, 1996; Whitworth, 1994 as cited in Bayona et al. 2006), while increasing service delivery numbers. Whereas, the benefit of using a combined model of service delivery is that occupational therapists are provided with the flexibility of implementing the strengths of both models, thus the services are better suited to meet the needs of the child (Case-Smith & Cable, 1996 as cited in Bayona et al. 2006), the teacher and parent.

One weakness identified in using a direct or combined model of service delivery, is that it may be costly (Bayona et al., 2006). Whereas, the consultation model may not provide the sufficient support or time the teacher may require to learn and to apply the strategies (Sandler, 1997 as cited in Bayona et al. 2006). In the study by Bayona et al. (2006) the authors identified 86% of the occupational therapists, at some point, provided direct service during the research study, which was designed to evaluate a consultation service delivery model. Using this type of service delivery model, parents and teachers reported their major concern experienced was the insufficient number of visits, while the occupational therapists reported their major concern was the lack of implementation of

the recommendations at home (Bayona et al.). Given the identified strengths and weaknesses of all the service delivery models, the trend reported in the literature was for the provision of consultation based service delivery models (Sandler, 1997 as cited in Bayona et al. 2006).

One literature source also identified that a form has been developed to measure occupational therapy service delivery models. The *Consultation Summary Form, (CSF)* Bayona et al. (2006), collects information from the therapist regarding the consultation process including strategies, methods, and perceived barriers to successful consultation. Although this was developed for the purposes of their research study, Bayona et al. reported it was designed based on a review of the literature and in consultation with school-based occupational therapists. The results of this study illustrated that the information required was successfully collected using this tool.

The literature sources within this section described the three occupational therapy models of service delivery and described the strengths and the weaknesses of each model. The next section described occupational therapy clinical reasoning.

5.2.1.2 Clinical Reasoning & The Collaborative Clinical Reasoning Process

Two of the literature sources described clinical reasoning and the clinical reasoning process. Clinical reasoning was described as a mental operation, which is the basis for problem solving. It was described as the interaction of theory linked with knowledge and clinical experience (Schwellnus, Boschen, Law and Young, 2009). Clinical reasoning was reported to be an essential component for medical and allied health professionals (Erhardt & Meade, 2005). The literature indicated, because clinical reasoning is an invisible mental operation, and is developed through experience, those who lack experience within the field of occupational therapy might demonstrate challenges with problem solving (Schwellnus et al.) due to conditions outside of the clinician's control. However, Schwellnus et al. indicated, "a decision guide can assist in the development of clinical reasoning skills" (2009, p.205). Whereas, Erhardt and Meade illustrated in their study that using the principle of collaboration, with mental operations such as narrative, procedural,

pragmatic and conditional reasoning, may lead to improvements in occupational function.

The information presented within this section described the mental operation known as clinical reasoning and the importance of this mental operation in occupational therapy practice. In the next section, evidence-based practice was described.

5.2.1.3 Evidence-Based Practice

Two literature sources illustrated that occupational therapists make decisions regarding practice, based on two types of methodology: Evidence-Based Practice (Lederer, 2004) and Practice-Based Evidence. The literature indicated, practice-based evidence is established through practical experiences and the resulting wisdom gained from the experience. Lederer identified that "within the field of occupational therapy, experiential learning is seen as critical to understanding" (2004, p. 31). Alternatively, evidence-based practice is established through documented research evidence, acquired through quantitative, randomized controlled trials, to support the interventions implemented within practice (Holm, 2000 as cited in Lederer). This was illustrated by Chu (1997) who purported that the fundamental role of occupational therapists include, remediating the underlying performance components, and that "there are many research studies providing evidence to support this area of occupational therapy" (1997, p. 519). Although individuals might advocate for one type of methodology over the other, the literature sources suggested that using evidence-based practice techniques as a starting point to guide the therapist, while consolidating the learning, should be strived for and utilized by all occupational therapists (Lederer).

The literature indicates pure implementation of evidence-based practice methods were reported to be challenging due to: the constraints on time and resources, departmental dynamics and support, lack of education and understanding of how to engage in the process, and due to personal abilities (Lederer, 2004). The literature sources indicated that an organizational culture which values: maximized efficiencies through increased caseloads and decreased professional development within work hours, further contributed to the challenges occupational therapists faced when implementing evidence-based

practices (Lederer). The literature also indicated, evidence-based practice is viewed as an outcome of quantitative research methodologies only, which suggested an instant valued hierarchy of truth, dependent on the research paradigm (Tickle-Degnen & Bedell, 2003 as cited in Lederer, 2004). However, the literature sources also indicated that as occupational therapy evolves, so too are individual perceptions of which research paradigms are valued. Where there once were only the hierarchical levels to categorize quantitative research (Moore, McQuay & Gray, 1995 as cited in Lederer), the literature sources indicated the addition of heterarchies for categorizing qualitative research (Lederer).

The information presented described the value of evidence-based practice within occupational therapy and the weaknesses inherent within this process. The next section described the information gathered on occupational therapy intervention.

5.2.1.4 Occupational Therapy Intervention

Four literature sources described the information gathered about occupational therapy interventions. The literature sources indicated that occupational therapists address a range of occupations, while servicing multiple clients within the education environment, including: the child, the child's family, and the teacher (Hammerschmidt & Sudsawad, 2004). "Typical areas of school-based evaluation and intervention are (a) mobility and transitions, (b) handling of classroom materials, (c) functional written communication, (d) activities of daily living, (e) school routines, and (f) socialization" (Diekema, Deitz & Amundson, 1998, p. 248). Occupational therapists use standardized tests and informal observations of students within the classroom to evaluate a child's skills and develop an effective intervention plan (Diekema et al., 1998).

The literature sources indicated, through collaborative, well-planned services, school-based occupational therapists identify the underlying deficits, which may be impacting development (Chu, 1997). The intervention is guided by an array of specific theoretical perspectives and approaches. One global perspective identified within the literature was the occupational perspective (Nelson, 1996, 1997 as cited in Peterson & Nelson, 2003).

Peterson and Nelson defined the occupational perspective as "the essential role of the occupational therapist is to collaboratively synthesize occupational forms that are meaningful and purposeful to the individual, so that the individual is able to engage in adaptive occupational performances" (2003, p. 153). Thus highlighting, irrespective of the theoretical approach, the occupational therapist's role is to create an environment for engagement in meaningful activities (Peterson & Nelson).

One literature source suggests that although occupational therapy is a valued profession, lack of awareness of occupational therapy services available continues to exist (Hammerschmidt & Sudsawad, 2004). It was recommended that occupational therapists advocate for their profession by "providing in-service to teachers about occupational therapy and occupational therapy services, as well as making themselves available to teachers for assistance with handwriting questions the teachers may have" (Hammerschmidt & Sudsawad, 2004, p. 191).

5.2.1.5 Summary: Sub-Factor: Health & Community Supports

The sub-factor, health and community supports were described. Based on the information gathered from the literature sources on handwriting; meaningful occupation, three service delivery models, clinical reasoning, evidence-base practice, and occupational therapy interventions were common themes found to describe the *occupational form*: occupational therapy. The next section, described the *occupational form*: technology.

5.2.2 Sub-Factor: Technology

Three literature sources described the occupational form: technology. The history of technology within the schools indicated as early as 1926, first grade classrooms were introduced to the positive impacts on academic learning, as a result of the typewriter (Conrad, 1935; Rowe, 1959; Sinks & Thurston, 1972; Wood & Freemand, 1932 as cited in Rogers & Case-Smith, 2002). The literature sources suggested, although the enthusiasm for technology subsided due to costs, in the mid-1980s and 1990s a majority of elementary schools provided computer-based technology options for children

(Balajthy, 1988, Belsie, 1995, Cochran-Smith, 1991 as cited in Rogers & Case-Smith). Rogers and Case-Smith described, accessibility to computers offered a variety of new academic opportunities for children. “The use of word processors for written communication is an emerging academic area in the public school curriculum that has recently received considerable attention by educators and school administrators” (Rogers & Case-Smith, 2002, p. 35). This led to the development of mandated technology outcomes within the elementary school system (Balajthy, 1988; Nieman, 1996 as cited in Rogers & Case-Smith).

As technology increases in educational popularity, Freeman, MacKinnon and Miller (2004) recommend it is fundamental for the occupational therapist to become aware of the technology being used within the educational setting. Various forms of high tech methods were described within the occupational therapy literature sources. This included: word processing, keyboarding, computerized word-prediction programs and software (Handley-More, Deitz, Billingsley & Coggins, 2003), speech recognition software (SRS), alternate output devices (AOD), alternate keyboard, electronic typewriter, electronic diary, and tape recorders (Freeman et al.). Additionally, technology strategies specific to a particular method of output were also identified within the literature sources. This included: (1) Keyboard-based strategies: desktop computers, laptop computers or alternate output devices (Freeman et al.). Whereas, (2) Dictation-based strategies included: dictation to a scribe, dictation to a tape-recorder, dictation using speech recognition software (Freeman et al.).

Commercial software programs, definitions and descriptions related to the programs, and instructional methods, were also found within the literature. This included, but was not limited to: (1) Microsoft ®Word, which is a word processor, a computer production application. Word processing is the act of using the computer, a word processor, and a keyboard, to record written expression (Handley-More et al., 2003). (2) Co:Writer 1.1 (1994) which is a word prediction program. Computerized word-prediction programs use “rules regarding word frequency and grammar to provide the user with a list of words. As the user types the first letters of the desired word, a list of possible words appears on the

screen and this list is revised until the desired word is predicted" (Handley-More et al., 2003, p.140). (3) UltraKey 3.0 (1995) teaches keyboard skills training. (4) Mavis Beacon Teaches Typing (Alston, 1985): is an instructional keyboard program (Rogers & Case-Smith, 2002).

5.2.2.1 Summary: Sub-Factor: Technology

The information from the literature sources presented within the sub-factor: technology, illustrated how technology was introduced into the education system, and described its increase in popularity over the past ninety years. The technology strategies identified within three occupational therapy literature sources illustrated various technology strategies or tools are available to occupational therapists.

5.3 SUMMARY: STRUCTURAL FACTORS

Fourteen of the seventy-five occupational therapy literature sources identified information on two *occupational forms*: (1) occupational therapy, and (2) technology. The themes in the literature indicated that occupational therapy values meaningful occupational engagement. The literature identified, regardless of the type of occupation, client, or environment, an occupational therapists' role in intervention, is to create an environment for meaningful occupations. Occupational therapists' possesses unique skills to support and advocate for, individuals and groups who experience challenges with occupational engagement. The literature also indicated that occupational therapy practice is conducted within three service delivery models. Each service delivery model presented unique strengths and weaknesses within the practice of occupational therapy. Although, given these strengths and weaknesses, the trend reported in the literature, was for the provision of consultation. Clinical reasoning skills and evidence-based practice were identified within the literature. The literature sources indicated that although these two concepts benefit the quality of occupational therapy practice provided, they possess an inherent challenge to the occupational therapist. Clinical reasoning is a mental operation, which requires experience, while evidence-based practice is a practice methodology, which

requires time and an organizational culture to promote this type of practice. The literature suggested that the environment or factors external to the occupational therapist impacts effective or efficient practice. The occupational therapy literature sources also described the history of technology within the schools. The literature indicated the implementation of technology in the schools dated back to the nineteen-twenties. The literature also identified that technology would provide a valuable educational resource within the school system. Various forms of technology identified within the literature, have been developed to suite specific, manual communication outcomes. No *occupational determinants* were identified in this integrative review although known literature sources exist. The next section, described the contextual factors found in the occupational therapy literature sources.

5.4 CONTEXTUAL FACTORS

Contextual factors describe the individual's biological, social and cultural characteristics that impact the outcomes of the occupation.

Out of the seventy-five sources obtained from the literature search strategy, fifteen sources were found to describe the *contextual factors*. A summary of the literature sources describing the contextual factors was provided (see Appendix P). From the literature findings, three contextual sub-factors were identified: Ability/Disability, Income/Wealth, and Ethnicity. The biological, social and cultural characteristics of each of these three *contextual factors* have been introduced and described within this section. As previously mentioned, the interaction between these three *contextual factors* and handwriting was described within the *Occupational Interactions* section.

5.4.1 Sub-Factor: Ability/Disability

"Children who have physical disabilities are integrated into mainstream schools, with the expectation that they will participate in classroom curriculum "(Dubois, Klemm, Murchland, & Ozols, 2004, p.90). In acknowledgement of the impact a physical or

cognitive, medical diagnosis may have on the functional engagement in handwriting; the information from the literature sources, describing diagnoses were provided. Specifically, thirteen literature sources provided information on six medical diagnoses found within the occupational therapy literature on handwriting. The integrated literature findings provide a review of these medical diagnoses.

The six biological characteristics identified within the occupational therapy literature included, in no particular order: (1) Mild Motor Difficulties/ Developmental Coordination Disorder, (2) Perceptual and Motor Weaknesses, (3) Cerebral Palsy/ Hemiplegia, (4) Preterm Births, (5) Attention Deficit Hyperactivity Disorder, and (6) Learning Disabilities. An overview of the medical characteristics and the implications of function within the education milieu were described. The unbalanced detail of the identified medical diagnoses and characteristics described within the integrated review was a reflection of the content identified within the literature sources. The literature sources were collected as a result of the parameters set on the methodology, specifically the literature search strategy.

5.4.1.1 Mild Motor Difficulties/ Developmental Coordination Disorder (DCD)

Children with mild motor difficulties are identified as those individuals who have challenges with fine and gross motor skills (Malloy-Miller, Polatajko, & Anstett, 1995). Due to the fine and gross motor difficulties, functional challenges are observed to have a significant impact on the child's ability to engage or participate in school based activities (Chu, 1997). Children with mild motor difficulties are commonly identified within the literature, however various terms are used to characterize their challenges, including clumsy, developmental coordination disorder and dysgraphia (Chu, 1997; Malloy-Miller et al.). Children with mild motor difficulties and therefore, occupational performance issues, are regularly referred to occupational therapists for assessment and treatment (Malloy-Miller et al.).

Developmental Coordination Disorder, otherwise known by its acronym: DCD is one commonly identified developmental disorder within the education system today. The

essential feature of this diagnosis is described as marked impairment in the development of motor coordination (American Psychiatric Association, 2000 as cited in Missiuna et al., 2008). Motor development, or the predictable, methodical acquisition of motor skills over a period of time in typically developing children, results in fluid, well-planned, executed motor movements. The ability to engage in daily occupations is the result of the complex interaction between motor functions, sensory processing, learning and memory (Miller, Missiuna, Macnab, Malloy-Miller, & Polatajko, 2001). However, children with developmental coordination disorder are observed to be clumsy, awkward or uncoordinated (Banks, Rodger, & Polatajko, 2008; Missiuna et al.), and are identified as having multiple impairments impacting performance (Miller et al., 2001). The literature suggests, that "DCD may in fact be a motor-based learning problem" (Rodger & Polatajko, 2005 as cited in Banks et al., 2008, p. 108). This belief supports why children with DCD continue to use the same, non-effective motor strategies during novel tasks (Missiuna, Mandich, Polatajko, & Malloy-Miller, 2001 as cited in Banks et al.) and why novel tasks, especially those which require complex interactions of motor movements are challenging.

DCD is a perplexing impairment and is becoming a typically described and diagnosed disorder in childhood and adolescence. The literature indicated, more boys are identified than girls (Dewy & Wilson 2001 as cited in Banks et al., 2008; Miller et al., 2001). Furthermore, the prevalence of DCD has been estimated to represent as high as 6% of the school-aged population (Dewy & Wilson as cited in Banks et al., 2008). Based on the literature review by Miller et al., in Canadian elementary schools, an equivalent of approximately 129,000 school-aged children would be identified as having DCD. Or, approximately 1 in 20 children will meet DCD diagnostic criteria (American Psychiatric Association, 2000 as cited in Missiuna et al., 2008). Miller et al. suggests "that at least half of all occupational therapy referrals for children with DCD occur during the primary grades" (2001, p. 8). However, "many children with DCD will not qualify for special education services" (Missiuna, Rivard, & Pollock, 2004, p. 5). Therefore, the impact of this diagnosis is threefold. The impact is on children's functional classroom performance and secondarily on their self-esteem, it also impacts the teachers' instruction and

occupational therapist's intervention. However, with tailored instruction and practice, these children may improve in targeted tasks (Missiuna et al. 2004).

5.4.1.2 Perceptual and Motor Weakness

Children may be identified within the classroom as having difficulties with perception and motor skills (Addy, 1996). Addy explains these children may demonstrate inconsistencies in their motor output and poor positioning of self to the activity. Children with perceptual and motor weaknesses may experience the impact of this type of weakness in all functional school-based activities.

5.4.1.3 Cerebral Palsy (CP) & Hemiplegia

Stanley, Blair and Albermann (2000) reported the incidence of cerebral palsy is "2.5 per 1000 live births" (as cited in Dubois et al., 2004, p. 90). Rosenbaum (2003) reported that children with, "cerebral palsy have a primary motor disorder, and may also have impairments in sensation, cognition, communication and / or perception" (as cited in Tam, Ryan, Rigby & Sophianopoulos, 2009, p. 403). Different forms of cerebral palsy exist. "Children who have the diagnosis of cerebral palsy with hemiplegia are one group of children with physical disabilities who commonly attend their local mainstream school" (Dubois et al., 2004, p.89). Khaw, Tidemann and Stern (1994) defined hemiplegia as, "a neuroimpairment with unilateral motor disability caused by a non-progressive defect or lesion of the immature brain" (as cited in Dubois et al., 2004, p. 90). Other associated impairments, identified with hemiplegia include: "learning and cognitive difficulties, seizures, visual and hearing impairments, behavioural disorders, speech, language and perceptual problems" (Khaw et al., 1994; Goodman & Yude, 1996; Frampton, Yude & Goodmand 1998; Cioni, et al., 1999; Stanley, et al., 2000 as cited in DuBois et al., 2004, p.90).

5.4.1.4 Preterm Children

Children born preterm, demonstrate deficits in motor, perceptual-motor, and visual-motor integration skills (Marlow et al, 1993; Goyen et al, 1998, Luoma et al, 1998 as cited in

Feder, Majnemer, Bourbonnais, Platt, Blayney & Synnes, 2005). Specific impairments including, neurological, learning and behavioral difficulties, and developmental difficulties were also found within the literature (Feder et al.). However, despite these difficulties, a majority of the children have average intellectual abilities (Bohm et al., 2002; Bowen et al. as cited in Feder et al.).

"Factors such as the extent of prematurity, perinatal medical complications, behavioral difficulties, sex, maternal education, and self-concept may be important predictor variables (Zelkowitz et al. 1995; Samson et al. 2002 as cited in Feder et al., 2005, p. 163). Feder et al. indicates, "persistent motor impairments are common features in preterm children" (Feder et al., 2005, p.163). Powls et al. (1995) indicated that children who are born pre-term may demonstrate significant motor impairments and challenges with manual dexterity at ages 12 to 13 years compared to typically developing children their age (as cited in Feder et al.).

5.4.1.5 Attention Deficit Hyperactive Disorder (ADHD)

Attention Deficit Hyperactive Disorder (ADHD) "is the most frequently diagnosed neurobehavioral disorder in childhood (Kauffman, 2001 as cited in Schilling, Washington, Billingsley, Deitz, 2003). The current estimates of school-aged children who have been diagnosed with ADHD in the United States are, 4-6% of children (Jaksa, 1998; Rosenblum, 2000, as cited in Schilling et al.). Mulligan (2001) describes "children diagnosed with ADHD often experience significant academic and sensory motor problems that make typical school activities a challenge" (as cited in Schilling et al., 2003, p.534). Because of the increasing numbers of children with ADHD, Mulligan (2001) recommended that occupational therapists be knowledgeable about ways of managing the classroom behaviors, and provide strategies, which enhance school performance (as cited in Schilling et al.).

Goldstein and Goldstein (1992) reported many children with ADHD experience a wide range of secondary behavioral and emotional problems at school, while Rosenblum (2000) reported more than one third of students with ADHD drop out of school (as cited

in Schilling et al., 2003, p.534). Furthermore children with ADHD, demonstrate sensory modulation deficits (Schilling et al.). Therefore Mulligan (2001) suggests "… one potential intervention approach to address the behavioral problems of children with ADHD at school is to adapt the environment to meet the children's needs" (as cited in Schilling et al., 2003, p.535).

5.4.1.6 Learning Disabilities (LD)

Within the occupational therapy literature on handwriting, Cermak and Henderson (1985) defined that "learning disabilities are characterized by deficits in learning that are related to academic achievement and may include problems in learning arithmetic, using oral or written language or both, and reading" (as cited in Handley-More et al., 2003, p.140).

5.4.1.7 Summary Of Ability/Disability

Six medical diagnoses were identified within thirteen literature sources categorized as *contextual factors*: ability/disability. The six medical diagnoses included: mild motor difficulties/ developmental coordination disorder, perceptual and motor weaknesses, cerebral palsy/ hemiplegia, preterm births, attention deficit hyperactivity disorder, and learning disabilities. The literature sources illustrated that mild motor impairments/ developmental coordination disorder were the most commonly and comprehensively described medical diagnosis within the occupational therapy literature on handwriting in the past fifteen years. The literature sources also revealed that the common characteristics between all of the identified medical diagnoses, suggest that sensorimotor: specifically motor skills; and cognitive skills are primarily impacted in school-aged children. No literature sources identified a primary issues with psychosocial skills, although secondary psychosocial outcomes to decreased sensorimotor or cognitive skills, were identified. Another common theme identified from the literature sources was that the medical diagnoses and resulting characteristics or symptoms, have a significant impact on the child's school-based performance in activities, particularly impacting the academic outcomes/achievements of these children, compared to typically developing children the same age. Lastly, the literature sources revealed that the prevalence of these medical

diagnoses is quite high. The percentage of school-aged children who are reported to have at least one of the diagnoses was up to 6%. The identification of the *contextual factors* within the occupational therapy literature on handwriting has illustrated that there are children within the school-system who demonstrate performance challenges, particularly affecting functional motor skills. Ethnicity was discussed within the next section.

5.4.2 Sub-Factor: Ethnicity

Ethnicity, as a *contextual factor*, was limited in the amount of literature sources identifying it. One literature source was found to describe ethnicity within the occupational therapy literature. Ethnicity was reported to impact the educational outcomes of children. The authors of this source cite numerous published works reporting the many factors contributing to the educational disadvantages of ethnic individuals, specifically, with regards to Australian, Indigenous children (McGarrigle &Nelson, 2006).

One factor, identified to contribute to the educational disadvantage of ethnic groups, included the lack of culturally relevant education services (Christie, 1992; Gutman, 1992; Tsey, 1997 as cited in McGarrigle & Nelson, 2006). It was also identified that the lack of social inclusion, may lead to secondary education challenges, including lack of school attendance (McGarrigle & Nelson). Gibson (1993) indicated that the secondary factors impacting the educational disadvantages of ethnic groups, including school absences, should be recognized as a symptom, rather than just a cause (as cited in McGarrigle & Nelson). Tsey (1997) suggested, deprived educational outcomes may lead to lower socioeconomic conditions, which includes, poor health, decreased employment, and poverty (as cited in McGarrigle & Nelson). One recommendation found within the literature sources to reduce the impacts of educationally disadvantaged children, was to provide educational programs that are culturally appropriate during the foundational early years of school-development (McGarrigle & Nelson). It was suggested that culturally appropriate educational supports within early development, might promote mastery of school-based skills and self- efficacy, which may influence the continuation of

engagement in school and higher education (McInerney, 1991; Gutman, 1992; Hudspith and Williams, 1994 as cited in McGarrigle & Nelson).

The common theme found within this literature source was the impact of ethnicity on educational outcomes. One solution was to provide culturally relevant educational programs, which as a result may reduce secondary impacts on education. The next section explores the impact of socioeconomic status on child engagement.

5.4.3 Sub-Factor: Income/Wealth

A very limited number of literature sources describing the impact of the child's economic status on his or her engagement within meaningful activities were found. The one identified literature source suggested that the socioeconomic conditions of the child's family and therefore the child, is linked to a child's health and development (The U.S. Department of Health and Human Services 2000 as cited in Peterson & Nelson, 2003). As a result, the deprived economic environment and social construct of the family was found to contribute to poor school performance (Wagner & Gomby, 1996 as cited in Peterson & Nelson).

5.5 Summary: Contextual Factors

Fifteen literature sources were identified to describe the *contextual factors* found within the occupational therapy literature on handwriting. Specifically, the three contextual sub-factors identified were: ability/disability, ethnicity, and income/wealth. Every sub-factor explicitly linked the impact of the contextual factor to the engagement in school-based activities and or educational outcomes. Furthermore, the occupational therapy literature sources revealed a disproportion of information within the distribution of the literature sources. More literature sources and information were gathered about the biological characteristics of the individual versus the social or cultural characteristics. The disproportion of literature sources was also noted within the sub-factors. Out of all the *contextual factors* identified, mild motor problems/developmental disabilities were the

most commonly indentified sub-factor. The next section within this chapter described the *Occupation Factors*.

5.6 Occupation Factors

Occupation Factors describe the occupation, specifically, the features unique to the occupation, including: the occupational performance, functional components and performance components.

All seventy-five of the included literature sources identified *occupation factors*. A list of the sources obtained was provided (See Appendix O). Not every literature source was cited within this section. This section provided an overview of the occupation of handwriting. Three sub-factors of the *occupation factor* were created: Handwriting, An Occupational Performance; Handwriting Functional Components; Handwriting Performance Components.

5.6.1 Sub-Factor: Handwriting, An Occupational Performance

Handwriting "can be operationally defined as the process of marking letters, words, or other symbols on a surface with a pen, pencil, or similar implement at an age-appropriate level of legibility and speed" (Freeman et al., 2004, p.151). Handwriting is considered an "…occupational performance fitting the productivity framework of the Canadian Occupational Performance Model (CAOT, 1997)" (Feder, Majnemer, & Synnes, 2000, p. 203). It is an occupational performance for the school-aged child "…in that it is an expected skill necessary for functioning in a mainstream classroom environment" (Feder et al., 2000 p.198). Handwriting, occupational performance areas include, independent writing, copying, composition (Jewell, 1999), note taking, writing examinations, or completing application forms (Feder et al.).

Handwriting is one of the elements of the written language skills (Freeman et al., 2004) encompassing reading, spelling, and writing (Jewell, 1999). The term writing "includes

several graphic skills including composition of ideas, spelling, and handwriting" (Jewell, 1999, p.33). Handwriting is "closely linked to academic achievement, especially composition and literacy skills" (Cahill, 2009, p. 223). It is a "visual representation of oral language, [it] is a complex psychomotor skill, not an innate ability" (Addy, 1996, p. 427).

Handwriting, as an occupational performance, is comprised of (1) functional components and (2) performance components. The literature reflected the opinions of numerous authors who maintain: there is little consensus and conflicting associations regarding the variables, which contribute to the occupation of handwriting (Bonney, 1992; Cornhill & Case-Smith, 1996; Daniel & Froude, 1998; Holliday, 1988; Malloy-Miller et al., 1995; Phelps et al., 1985; Reisman, 1993; Rubin & Henderson, 1982; Simons 1995; Windsor, 2000; Ziviani & Elkins, 1986). The variables or components of handwriting, which were described within the literature, were reviewed in the next two sections.

5.6.2 Sub-Factor: Handwriting Functional Components

The functional components have been described and debated in a variety of sources (Chu, 1997). The functional components of handwriting include (1) handwriting analysis, (2) ergonomics and biomechanical factors and the (3) content of the writing (Chu). Functional components describe the interaction of the body with the mechanics of the occupation, and writing language skills (Chu).

5.6.2.1 Handwriting Analysis

The literature sources describing handwriting analysis, or the quality of writing, included but was not limited to: letter formation, size, alignment, word space, word alignment, fluency, age expectations, letter joins, letter spacing, consistent slant, work speed, individual style, pressure (line thickness), neatness, attractive handwriting style, letter consistency, tremor, letter reversals (Daniel & Froude, 1998); line quality, closure, size relation of letters within words, baseline orientation, spacing of letters within words and size of letters between words (Malloy-Miller et al., 1995); legibility (two main types (1)

global legibility: overall level of readability versus (2) component legibility: describing the components which make up legibility: form, alignment, size and spacing) (Diekema et al., 1998; Roberts, Siever & Mair, 2010; Sudsawad, Trombly, Henderson, & Tickle-Degnen, 2001); handwriting proficiency (includes both speed and legibility (Ziviani & Watson-Will, 1998).

5.6.2.1.a. Common Handwriting Styles

The combination of the functional components and the performance components create a written outcome, which may vary in style. Style refers to the taught structure of letter formations mixed with personal influence. Three styles were described within the literature, the Zaner-Bloser method, D'Nealian method and the Modern Cursive Script method.

One style is the Zaner-Bloser instruction method. Letters are taught using a commonly referred to term "ball and stick method"; a term that describes letters being formed with straight lines or circle-like curves referred to the traditional handwriting method (Ziviani & Watson-Will, 1998).

A second style is the D'Nealian method. The D'Nealian method "uses a slanted style of letter formation for manuscript and for cursive based on the rationale that the transition from manuscript to cursive writing will be easier with the slanted approach" (Shimel, Candler, & Neville-Smith, 2009, pg 172). The D'Nealian method was considered an alternative method which would alleviate the challenges students may have experienced using the Zaner-Bloser method (Shimel et al.). Peterson and Nelson (2003) reported that D'Nealian printing is commonly taught in schools. However, controversies exist regarding which type of script should precede cursive writing (D'Nealian, or traditional manuscript alphabet), thus making the transition to cursive handwriting easier (Armitage & Ratzlaff, 1985; Brown, 1984; Duvall, 1985; Graham, 1994; Viadero, 1993 as cited in Peterson & Nelson).

The final style identified was the Modern Cursive Script method. This method is similar to the D'Nealian method but differs from the traditional "ball and stick" style because modifications have been made to the script (both printed and cursive) to allow for a successful transition from print to cursive through the introduction of joiners (Ziviani & Watson-Will, 1998). In addition, the script is oval (not circular) and the lines are slanted (not vertical) in both print and cursive forms (Ziviani & Watson-Will). It was suggested that because of these features, the transition between print and cursive writing would be easier (Ziviani & Watson-Will).

The literature sources obtained described the multiple variables identified within handwriting analysis, including appearance, writing case and writing style. Handwriting analysis makes up one third of the variables comprised within the functional components of handwriting. The literature sources described the ergonomic and biomechanical factors within the following section.

5.6.2.2 Ergonomic and Biomechanical Factors

The ergonomic and biomechanical factors of handwriting identified within the literature sources included but was not limited to: grip, or the pattern of his or her fingers the child holds the pencil with, shoulder posture, forearm posture, (Chu, 1997); dynamic grips (thumb opposed to the index finger), lateral grips (unopposed thumb position) (Summers, 2001); grip force: forces exerted radially on the barrel of the writing utensil, normal forces: downward force applied perpendicularly to the writing surface at the tip of the writing utensil (Chau, Ji, Tam, & Schwellnus, 2006, p. 1542); paper position, body posture including sitting upright, and midline crossing (Clark-Wentz, 1997).

The ergonomic and biomechanical factors identified within the literature sources, such as pencil grasp, pressure, and body posture were illustrated within this section. The next section described handwriting content and other factors, which comprise the final section within the functional components of handwriting.

5.6.2.3 Handwriting Content & Other

The content of the writing and other observations identified within the literature sources included, but were not limited to: capitalization, punctuation, fatigue, hesitation, frustration, and a child's reaction to written mistakes (Chu, 1997).

5.6.3 Sub-Factor: Handwriting Performance Components

The performance components described in the literature were included under three performance component headings: (1) Sensorimotor: sensory integration and neuromuscular (Clark-Wentz, 1997), (2) Cognitive skills, and (3) Psychosocial (Chu, 1997). These performance components were described in further detail.

5.6.3.1 Sensorimotor Performance Components

Sensorimotor components may be broken down into sensory integration and neuromuscular components (Clark-Wentz, 1997). In addition, sensory integration may be broken down into sensory processing skills (which includes proprioception and kinesthesia), sensory awareness (which includes visual and auditory skills), and perceptual motor skills (visual perception, visual motor integration) (Clark-Wentz).

The sensorimotor performance components documented within the literature included, but were not limited to: stability (including baby and ring fingers, upper body and shoulders), dexterity, strength and precise coordination of muscles (including those in the hand and forearm) skilled movements and muscle control, sensory information, visual skills, (Saunders, 2010); pencil control, joint laxity (Summers 2001); orthographic coding: "the ability to develop an intact representation of the letters of the alphabet and rapidly and accurately encode and reproduce them from memory" (Weintraub & Graham, 2000, p.123); motor planning (Cornhill & Case-Smith, 1996); proprioception: "the process by which we understand where our limbs are in relation to our body" (Addy, 1996, p.428); and kinesthesia: "awareness of weight of an object (and of a limb) and the directionality of joint and limb movement" (Cornhill & Case-Smith, 1996, p.733).

5.6.3.2 Cognitive and Psychosocial Performance Components

The cognitive components described in the literature sources included, but were not limited to: attention, memory, language comprehension, and reasoning (Chu, 1997; Clark-Wentz, 1997). Whereas the psychosocial skills included, but is not limited to: self-esteem, interests, self-value, self-concept (Clark-Wentz).

The literature sources obtained on the performance components of handwriting illustrated that sensorimotor components are commonly cited within the occupational therapy literature on handwriting. Very few literature sources contributed to the understanding of the cognitive or psychosocial skills elicited during the performance in handwriting.

5.7 SUMMARY: OCCUPATIONAL FACTORS

This section reviewed the components that comprise the o*ccupation factor*. The literature sources obtained illustrated the complexities of the occupational performance of handwriting. Due to the identified complexities, conflicting opinions within the occupational therapy literature regarding the variables, which contribute to successful handwriting, were presented. The few opinions included only briefly summarized the conflicting nature of the variables, which will be presented in further detail within the following section on *occupational interactions*. The two variables or components the literature sources described were the: functional components and the performance components. The functional components were described as the observable variables involved in handwriting: pencil grasp, letter orientation on the page, handedness. Alternatively, the performance components were described as the physical, cognitive or psychosocial skills such as motor planning, attention and self-esteem. Within each of these two variables, the literature sources also described the variations in the sub-components, such as different handwriting styles, different grasps and different visual perceptual skills. This adds to the complexity of the occupation. The literature sources illustrated a disproportion in the number of publications favoring handwriting analysis, grasp and sensorimotor skills. This section reviewed the intricacy of the components and the skills which comprise the occupation of handwriting.

The purpose of this integrated review was to better understand the occupation of handwriting and the factors contributing to an occupational injustice in handwriting. The *Revised Framework of Occupational Justice* has been used to organize the literature sources thus far, into categories, as a method to understand the factors contributing to the conditions of occupational injustice. In using the revised framework, the integrated review has established that handwriting is the occupation of concern. *Structural* and *contextual* and *occupation factors* have been introduced. However due to methodological limitations, not all of the known factors have been discussed. The next stage within the integrated review and the exploratory process of occupational justice was to synthesize the *occupational interactions*.

5.8 Occupational Interactions

The *Occupational Interactions* factor describes the dynamic interaction between the *structural*, *contextual* and the *occupation factors*.

All seventy-five, literature sources described information on the *occupational interactions* between the *structural, contextual* and *occupation factors*. A summary of the literature sources that were included was provided (see Appendix O). Six sub-factors have been identified within the literature sources including the interaction between the: (1) child and handwriting, (2) teacher and handwriting (instruction and evaluation), (3) the teacher, occupational therapist, and handwriting, (4) occupational therapy and handwriting, (5) occupational therapy assessment of handwriting, and (6) occupational therapy treatment of handwriting. The simple interactions prefaced the more complex interactions. Therefore, each sub-factor described, evolved in the complexity of the interactions. This section was considered the most significant section. This is because all of the literature sources described the occupational interaction between handwriting and the factors. One strength of an integrated review research method is that multiple sources may be integrated to better understand the problem or phenomenon. All of the factors have been presented thus far, but the synthesis of the interactions between the factors and the occupation, to better understand handwriting has not been achieved. Therefore, this

section integrates the findings from the literature sources that described the *occupational interactions* of handwriting, to better understand the occupation. It was anticipated as a result of this fusion of the findings from the literature sources, the conditions contributing to the occupational injustice might be identified.

5.8.1 Sub-Factor: Children And Handwriting

The interactions between the child and handwriting were described within this section. The *Revised Framework Of Occupational Justice* was used to categorize the interactions found within the literature sources. The literature sources illustrated that the interactions which occur within this sub-factor, are a result of the *contextual* and the *occupation factors*. Particularly, the literature sources obtained described the interactions of age, gender, ability and disability with the occupational performance and functional components of handwriting: legibility, speed and grasp. These interactions will be described within this sub-factor.

The literature indicated that the primary role of the school-aged child is that of the student (Handley-More et al., 2003, p. 139). As a student, the acquisition of handwriting is an important occupational performance in early elementary education (Marr, 2005). Handwriting was described within the literature as a complex and essential school-based skill, which integrates cognitive, motor and language abilities (Malloy-Miller et al., 1995). The relationship of the child and his or her experience with the engagement of the occupation of handwriting was reported in the literature. The following six statements summarized the beliefs commonly found in the literature sources and influence the interactions described in this sub-factor:

1. Handwriting is a meaningful and major childhood occupation (Cunningham, 1992)

2. Handwriting is important to demonstrate knowledge (Cornhill & Case-Smith, 1996).

3. Students spend a majority of their time in fine motor activities in which handwriting predominates (McHale & Cermak, 1992)

4. Handwriting may lead to frustration in the older years when the writing task increases in difficulty, particularly if skills were not adequately taught (Clark-Wentz, 1997 p. 31).

5. The secondary impacts of poor handwriting include poor academic outcomes, behavior and decreased self-esteem and self worth (Clark-Wentz, 1997; Feder et al., 2000; Hammerschmidt & Sudsawad, 2004; Malloy-Miller et al., 1995).

6. "…Many children with no identified exceptional educational needs still have handwriting difficulties that need to be addressed" (Judkins, Dague & Cope, 2009, p. 2).

5.8.1.1 Typical Handwriting Development

Typical handwriting development within school-aged children was identified within the literature sources and described within this section. According to the literature review conducted by Daly, Kelly, and Krauss (2003) the typical development of children's handwriting spans from four to six years of age. Windsor (2000) reported that at the early end of this age range, children in preschool, should not be focusing on pencils and pens and tabletop exercises which focus on the development of handwriting skills. Rather, she believes preschool children should engage in whole body play, exploration of the environment and tool use (Windsor). Chu (1997) indicated that despite the diverse readiness skills needed for writing, by the age of 6 or 7 years of age, many children, are becoming fairly proficient at writing in the school setting through traditional instruction practices. Jewell (1999) reported a similar trend, suggesting that in kindergarten the first stage of the writing progress begins, as letters and sounds are introduced. Marr and Cermak (2003) also supported this, they suggested that a child's first exposure to handwriting would be in the kindergarten year. Handwriting performance of children in kindergarten varies depending on the time of the year (Marr, Windsor, Cermak, 2001). It was identified that in the first quarter of the kindergarten year, only half of the typically developing children were able to copy the first nine forms on the Beery VMI (Daly, 2003). While children in the later half of kindergarten were reported to have the foundational skills required for formal handwriting instruction (Marr et al.). Marr and Cermak explained that, deficiencies identified in the kindergarten year might be

temporary because "developmental maturation, academic instruction, and practice may be sufficient to counteract any initial lack of skill" (2003, p. 161).

In the primary elementary years, "children may not be [able] to produce fast and highly legible writing simultaneously, the latter being sacrificed for the former" (Ziviani & Watson-Will, 1998, p. 64). Therefore, variability in handwriting performance may be observed. Diekema et al. (1998) reported there is variability in children's handwriting performance and that this variability is due to the complex nature of the occupation, leading to inconsistent quality. "Young children exhibit a high level of variability in performance, particularly in early elementary school years when handwriting is being taught and mastered" (Diekema et al., 1998, p. 253).

However, this finding was not supported by the results of Marr and Cermak's (2003) longitudinal study. The handwriting performance of typically developing children in kindergarten through to grade one was studied. The authors identified that a "moderately consistent pattern of handwriting performance exist in typically developing young children" (Marr & Cermak, 2003, p. 165). Marr and Cermak also identified that children whose handwriting skills were initially low or average in kindergarten, demonstrated significant improvement in handwriting performance over the year.

Conversely, in a different longitudinal study conducted by Marr (2005), she concluded, "consistency between performance in kindergarten and in third grade, especially among low performers, does not exist" (p.146). Marr indicated that the decline in performance of handwriting over a longer period of time, "suggests that performance may be more consistent in the initial elementary period but that variability in performance is demonstrated over longer periods of time" (Marr, 2005, p.146). Marr offers her prediction on the factors that may have influenced the inconsistency in performance: unevenness in developmental maturation, familial expectations of handwriting, and the influence of personal computer use. Based on the literature findings of these authors, children whose handwriting performance is average and above at kindergarten, may demonstrate a higher

chance for consistency in their handwriting performance from kindergarten to grade one. However, current handwriting performance may not predict future performance.

5.8.1.1.a Impact Of Age And Gender On Children's Handwriting

Typical handwriting speeds have been identified within the literature. The writing speeds of Australian children, ages 7 to 12 years, using modern cursive script, ranged from 34.90 to 110.76 for boys and 38.77 to 84.68 for girls, as identified by the Handwriting Performance Test (Ziviani, 1996; Ziviani & Watson-Will, 1998). Ziviani and Watson-Will observed speed differences, "with girls writing a little faster at ages 7-10 but boys being faster at ages 11 and 12 years" (1998, p.63). Similarly, the mean speed scores of fourth grade children, using a variety of pencil grasps, were 13 to 75 letters/minute (Koziatek & Powell, 2003). Likewise, Wallen and Mackay (1999) identified year 3 girls wrote significantly faster than year 3 boys, however, no speed to gender differences were found in year six. Conversely, Feder, Majnemer, Bourbonnais, Blayney, and Morin (2007) identified that grade one boys and girls did not demonstrate differences in writing. Feder et al. (2007) commented, "the students demonstrated wide variability in handwriting speed, particularly for lower and upper case alphabet writing" (p.50)… "as well for word, letter and numeral legibility scores in regular Grade One students" (p. 59).

Although trends are identified in the speed of handwriting, there is "variation on the basis of skill proficiency… true proficiency needs to encompass both speed and legibility" (Ziviani & Watson-Will, 1998, p.63). Children's handwriting legibility has also been identified within the literature. Ziviani and Watson-Will identified the mean legibility scores of children, using a legibility scale (1= poor legibility to 7=good legibility) with good reliability (ICC= 0.79). Mean legibility ratings of Australian children, 7 to 12 years of age, were significantly higher for girls than boys ($p<0.0001$) (Ziviani & Watson-Will). This finding suggests "girls are able to maintain higher levels of legibility than boys (Ziviani & Watson-Will, 1998, p.63). Similarly, other sources identified a significant difference in legibility between boys and girls in grade one, with boys' legibility being lower than girls (Feder et al., 2007). Specifically, this was observed in Total Word, Total Letter and Total Numeral Legibility on the ETCH-M (Feder et al.). Conversely, some

literature sources illustrated there were no significant differences between boys and girls letter legibility change scores (Weintraub & Graham, 2000; Peterson & Nelson, 2003; Zwicker & Hadwin, 2009). Regardless of the discrepancies of the skill levels between boys and girls, the literature consistently illustrated a higher boy-to-girl ratio of identification for handwriting concerns (Case-Smith, 2002; Zwicker & Hadwin).

Malloy-Miller et al. (1995) identified that handwriting speed ($r= -0.41$, $p<0.001$) and age ($r= -0.54$, $p<0.001$) significantly correlated with the writing factor execution/ coordination, which includes: line quality, closure, and size relation of letters within words. Similarly, Ziviani and Watson-Will (1998) used a Pearson product-moment correlation analysis and reported, "overall, in the context of the one task when children were required to write quickly their legibility was compromised" ($r=0.23$, $P>0.05$) (p.63). Implying, "as with all skill acquisition, attaining quality is the precursor to speed. If quality is not addressed, then practice will ensure permanence but not perfection" (Ziviani & Watson-Will, 1998, p.64).

5.8.1.1.b Children's Grip & Handwriting

Children's pencil grip patterns while handwriting have also been documented in the literature. Yakimishyn and Magill-Evans (2002) identified that very few typically developing children, 23 to 24 months of age, have established a preferred grasp pattern, although the digital pronate grasp was the most common grasp observed. Burton and Dancisak (2000) concluded the grip of children ages three, four, and five years old were identified to "fit into one of Schneck and Henderson's (1990) 10 categories" (p. 15). Older children were found to use higher-level (more mature) grip patterns compared to younger children (Burton & Dancisak). Similarly, Oehler et al. (2000) identified that the most frequent grasp used in typically developing kindergarten children, was any grasp other then the tripod. Therefore, the findings "support the literature that indicates that many kindergarten-aged children do not use the dynamic tripod or lateral grasps (Oehler et al., 2000, p. 58). The most typical grasp patterns used by Australian children ages 7years 5months to 8years of age, were the lateral tripod grasp (35%) and dynamic tripod grasp (27%) followed by the lateral quadrupod (18%) and the dynamic quadrupod (16%)

(Summers, 2001). Summers found that a majority of seven-year-old children (71%) demonstrated joint laxity. “The joint most often lax was the IP joint [interphalengeal joint] of the thumb” (Summers, 2001, p.136). However, overall the relationship between joint laxity and pencil grasp was not identified as significant and “the two major variables of the pencil grasp were the thumb position and the number of fingers used” (Summers, 2001, p.139).

Similarly, the most frequently observed grips in fourth-grade students (both typically developing children and children receiving special education services) were the: dynamic tripod followed by the lateral tripod, lateral quadrupod and the dynamic tripod (Koziatek & Powell, 2003). There were no statistically significant differences between the dynamic tripod, dynamic quadrupod, lateral tripod, and lateral quadrupod pencil grips for the ETCH-C total word legibility, total letter legibility and speed scores (Koziatek & Powell). The results suggest “dynamic quadropod, lateral tripod, and lateral quadrupod should be considered mature pencil grips equal in function to the dynamic tripod” (Koziatek & Powell, 2003, p. 287).

The influence of the grasp pattern on handwriting legibility during short and long writing tasks of typically developing grade four students was investigated (Dennis & Swinth, 2001). Dennis and Swinth reported that half of the students were found to use a dynamic tripod grasp, whereas the top three grasps used in the other half were: quadropod grasp, followed by lateral quadropod followed by a lateral tripod grasp. No primitive grasps were observed in these fourth grade students. Although the complexity of the writing tasks differed (i.e. some were required to copy while others were required to compose), there was a significant difference found between letter legibility scores on the short (being higher) than the long writing task. However no significant difference was found between the various grasps and scores on letter and word legibility of the ETCH and no significant interaction affect for grasp and task length was identified (Dennis & Swinth).

Additionally, able-bodied children and children with handwriting difficulties, with the mean ages of 6.7 and 8.3 respectively, were investigated for grip and normal forces

during handwriting (Chau et al., 2006). The literature results indicated that grip-related quantities statistically differentiated between writers with and without handwriting difficulties (Chau et al.).

5.8.1.2 Children With Disabilities & Handwriting

The impact of medical diagnoses or developmental disabilities on the handwriting performance of a child was identified within the literature sources. Specifically, the interactions between the handwriting abilities of children with mild motor difficulties/developmental coordination disorder, perceptual and motor weaknesses, cerebral palsy & hemiplegia, and children born pre-term were described.

5.8.1.2.a Children With Mild Motor Difficulties/ Developmental Coordination Disorder & Handwriting Abilities

Children with fine motor difficulties, and who struggle with handwriting may display numerous characteristics such as: writing slowly, the process may appear laborious, the child may report frustration, or refuse to handwrite (Missiuna, 1999). These children may demonstrate challenges in sensorimotor, cognitive and/or psychosocial performance component areas, resulting in their functional handwriting challenges (Missiuna). "Children with fine motor difficulties face the same learning challenges as their typically developing peers, with the added stress of mastering new or otherwise difficult motor skills" (Missiuna, 1999, p. 90).

Children with DCD also experience handwriting problems (Missiuna et al., 2008). These children experience daily frustration in the engagement of handwriting activities, particularly because "their finished work does not reflect their abilities" (Missiuna et al., 2004, p. 2). Children with DCD understand their instructor's directions, however these children proceed to demonstrate difficulties in successfully participating in the activity (Miller et al., 2001), or not engage in the activity at all. Children with DCD may exhibit unusual ways for forming letters, or may demonstrate difficulties with organizing written work on the page, or achieving efficient writing speed.

5.8.1.2.b Perceptual And Motor Weaknesses & Handwriting Abilities

Children with perceptual and motor weaknesses typically demonstrate poorly formed letters, inconsistent sizing, erratic spacing of letters and words, inversions, mixed capital and lower case letters, poor positioning of self with paper, excessive pencil pressure, and difficulties organizing letters on the page (Addy, 1996).

5.8.1.2.c Children With Cerebral Palsy/ Hemiplegia & Handwriting Abilities

Rigby and Schwellnus (1999) identified that children who have cerebral palsy may demonstrate functional challenges when handwriting, including: "poor sitting posture, with face close to the page, and poor grasp", (p. 20) "poor legibility, which involves spatial disorganization and inconsistent sizing of their work, and slow completion of writing tasks" (p.21), impaired motor control impacting pencil control and therefore quality of letter formations and speed. "Many children with cerebral palsy have difficulty keeping up with the handwriting demands at school. Their handwriting may be difficult to read, laborious to perform and much slower than their peers" (Rigby & Schwellnus, 1999, p.6). Rigby and Schwellnus highlighted, depending on the type of cerebral palsy, a child may demonstrate unique variances in handwriting performance issues.

The handwriting performances of children with hemiplegia have been documented in the literature (DuBois et al., 2004). DuBois et al. identified the handwriting difficulties children with hemiplegia, ages eight to thirteen experience, compared to peers, as reported by teachers and parents. Findings illustrate that both teachers and parents identify handwriting difficulties, with the majority of difficulties identified within the component areas: functional writing and neatness (DuBois et al.). Teachers and parents also identified organization of writing, and speed as concerns impacting writing (DuBois et al.). Additionally, DuBois et al. identified boys were identified as having more problems with handwriting overall. Teachers and parents both identified difficulties with posture, followed by difficulties with pencil grasp (Dubois et al). Parent report identified a higher percentage of the students experienced pain compared to the teacher report (DuBois et al.). DuBois et al. identified the variability of handwriting performance was

described as a feature of cerebral palsy that is not fully appreciated. In addition, "the prevalence of handwriting problems increased in the presence of coexisting conditions, in particular epilepsy and to a lesser degree speech and language and visual problems" (DuBois et al., 2004, p.97).

5.8.1.2.d Children Born Preterm & Handwriting Abilities

The handwriting performances of children born preterm, specifically, the findings of grade one children's handwriting performances compared to controls, have been documented within the literature (Feder et al., 2005). Children born pre-term demonstrate significantly lower word and letter legibility ($p<0.01$) and significantly slower writing speeds ($p<0.005$) (Feder et al.). An association between gender and letter legibility was also found, indicating preterm boys demonstrate significantly lower scores (Feder et al.). There was no significant association established between legibility, speed and gestational age or psychosocial factors (Feder et al.).

Feder et al. (2005) also documented that the typical grasps used by children born preterm were remarkably similar to the control findings; the most common was a static tripod grasp (46.5%) followed by the lateral tripod grasp (25.6%). Feder et al. identified, children born preterm demonstrated significantly lower sensorimotor abilities (as measured by the Bruininks-Oseretsky Test of Motor Proficiency (not all subtests), Visual Motor Integration, Test of Visual Perceptual Skills, translation and rotation) compared to typically developing peers. These findings suggest "children born preterm are more likely to face multiple challenges in their daily functioning at school" (Feder et al., 2005, p.168).

5.8.2 Summary: Children And Handwriting

The literature sources described the *occupational interactions* between the *contextual factors:* characteristics of children with and without medical diagnoses, and handwriting. Information from the literature sources illustrated that the interaction between the child and handwriting is significant. Handwriting was established as a meaningful and

significant school-based occupation that enables a child to demonstrate their academic knowledge. The literature sources illustrated that poor handwriting impacts a child's frustration, self-esteem, and grades; and that handwriting problems may be present without a medical diagnosis. Typical development of handwriting skills, established within the literature sources, occurs pre and post kindergarten. The literature sources presented conflicting information regarding the consistency of handwriting skills longitudinally. Conflicting information within the literature sources was also presented on the impacts of gender and age, on speed and legibility of handwriting. However, the literature revealed with relative agreement that boys are identified with handwriting concerns more often than girls. Typically developing children were reported in the literature to demonstrate an inverse relationship between legibility and speed: as speed increases, legibility decreases (Ziviani & Watson-Will, 1998). The information from the literature sources on grip patterns of typically developing children also presented conflicting information regarding the typical grasp observed and the most efficient grasp used to handwrite. Additionally, the literature sources illustrated that children with developmental disabilities such as fine motor difficulties, demonstrate similar functional handwriting concerns as their typically developing peers (Missiuna, 1999). However, the severity and probability of the handwriting concerns may be greater in children with developmental disabilities. This section illustrated the interactions between the child and handwriting. Even with the abundance of the literature sources identified, conflicting and disproportionate information was found on the *occupational interactions* between *contextual factors* and handwriting within the literature sources. The next section described the interactions between the teacher and handwriting.

5.8.3 Sub-Factor: Teachers And Handwriting

The literature sources collected and described in this section, illustrated the *occupational interaction* between a *structural factor* and an *occupation factor*. Specifically, the roles of the teacher (*occupational form*) in relation to the occupation of handwriting (*occupation factor*), particularly teachers' handwriting instruction and evaluation, were presented.

5.8.3.1 Teacher's Handwriting Instruction

Handwriting is identified as a major occupation within the school day (Addy, 1996). The teacher's instructional methods are therefore, a major feature of a child's occupational engagement. The instructional methods of a teacher were discussed within this section of the chapter.

Addy (1996) documented "there can be agreement that handwriting needs to be taught appropriately and consistently from an early age" (p.432). However, the methods of instruction reported within the literature have not reached the same level of agreement. Typical handwriting instruction methods may vary (Asher, 2006). Some teachers may teach handwriting in the context of the academic topic, thus using a whole language approach to instructing handwriting (Jewell, 1999; Vreeland, 1999). Others may provide direct instruction (Jewell), where the academic focus is placed explicitly on the instruction of handwriting. The amount of additional support given to children is dependent on their grade and ability. Kindergarten teachers typically show students how to form all of the letters of the alphabet and how to write their name (Jewell), whereas, in older grades, the focus may only be on reviewing the letters. Jewell reported that in order to accurately observe the educational outcomes in handwriting, the student must first receive an adequate amount of instruction time.

Duff and Goyen (2010) reported that the type of handwriting scripts might vary across districts, states and countries. This is supported by Asher's (2006) study findings, which used a teacher questionnaire method to identify current teaching methods. Asher reported that from kindergarten to grade six, within one school district, numerous instructional inconsistencies in handwriting were identified. This included inconsistent teacher agreement on: age when handwriting is taught, age when correct letter formation is taught, the type of paper used, the programs used for writing instruction, order of letters taught, practice time provided, and when cursive instruction should be introduced (Asher). Asher identified educators in one school district were found to use a variety of methods with "no continuity of instruction between the grade levels" (2006, p.469).

Asher concluded that this would impact a child if he or she moves within the school district, it would impact the teachers because of the varying skill levels found within a classroom at the beginning of each year, and it would impact the occupational therapists who have to organize and provide appropriate services based on how much, and in what form handwriting has been instructed, per individual classroom they work in. Consequently, Asher suggested there is a "need for structuring handwriting instruction, which should be aligned from kindergarten through the subsequent grade levels" (2006, p. 469), because "elementary students need structured instruction to develop the motor skill of writing"(Asher, 2006, p.461). It was concluded, consistent academic instruction and practice might be sufficient to counteract initial handwriting problems children experience (Marr & Cermak, 2003).

Cahill (2009) reported that the impacts of handwriting instruction and practice is linked to academic achievement. Clark-Wentz (1997) stressed, handwriting must be taught because students do not learn handwriting skills through passive observation. If teachers continue to dismiss formal instruction, "we may miss the 'writing on the wall' (Cahill, 2009, p.223). "Often if the teaching of handwriting is not emphasized in the early years of education, problems begin at that stage" (Chu, 1997, p. 515).

Given this integration of literature findings and the identified impacts on the child's occupational performance, "it might be assumed that [handwriting] would be well taught in terms of both its graphic and its compositional aspects" (Addy, 1996, p. 427). However, most teachers do not receive any training in handwriting instruction in undergraduate experience or in workshops (Marr, 2001). Teachers report they do not know what to teach, how to teach, or at what age to being instruction (Kiss, 2007; Marr). Ziviani and Watson-Will (1998) report, until teachers themselves are educated in handwriting methods and writing styles, it is difficult to ensure uniform and consistent instruction.

The literature sources also identified that teachers need to teach to all skill levels. Because "the typical pace of handwriting instruction in the classroom is often too fast for students

with disabilities (Jewell, 1999, p. 34). Furthermore, "while some students are able to master handwriting skills regardless of the teaching method, many with and without learning disabilities require a systematic, teacher-directed approach" (Vreeland, 1999, p. 8). Cahill (2009) indicated that one of the first things a teacher can do for a child who has special needs is to provide the child with formal handwriting instruction. Weintraub and Graham's (2000) study findings conclude it is necessary to provide "sufficient support, for the practice of directly teaching visual-motor and motor skills to children with handwriting difficulties" (p. 135).

One literature source illustrates how teaching strategies may support the handwriting performance of children with Developmental Coordination Disorder (DCD) who struggle with handwriting. One strategy identified was the "M.A.T.C.H" strategy (Missiuna et al., 2004). M.A.T.C.H stands for: "Modify The Task, Alter Your Expectations, Teach Strategies, Change The Environment, Help By Understanding" (Missiuna et al., 2004, p. 6). Teachers may use this general strategy to encourage learning and maximize efficiencies in the teaching and learning environment.

The *occupational interaction* between the teacher and handwriting instruction was illustrated. The next sections described the *occupational interaction* between the teacher and handwriting evaluation followed by a summary of the *occupational interactions* between teachers and handwriting.

5.8.3.2 Teacher's Handwriting Evaluation

The *occupational interaction* between the teacher's evaluation and handwriting was illustrated within the literature sources. The literature sources revealed, the two most popular methods, reported by teachers, to evaluate handwriting were to compare the student to the rest of the students within the classroom, and/ or compare the student's handwriting to a book (Hammerschmidt & Sudsawad, 2004). A majority of teachers grade students on the quality of handwriting (Hammerschmidt & Sudsawad). The specific criteria teachers use when determining acceptable handwriting includes: correct letter formations, directionality, and proper spacing (Hammerschmidt & Sudsawad). The most

important criterion for determining handwriting difficulties was not being able to read the student's writing. (Hammerschmidt & Sudsawad). In addition, there were a percentage of teachers (10.5%) who reported they do not evaluate handwriting (Hammerschmidt & Sudsawad).

The validity of teachers' evaluation of handwriting has also been investigated in the literature. Cornhill and Case-Smith (1996) concluded, when teachers were given a specific set of criteria to judge penmanship, the teachers' ability to distinguish good from poor handwriters as determined by the Minnesota Handwriting Assessment, was remarkable; 98% of students were correctly classified. Wallen and Mackay (1999) concluded that teachers' ability to rate slow and fast handwriters in years 3 and year 6 as established by the Handwriting Speed Test, illustrated a low rate of incorrect classification and a higher rate of correct classification in both years. However, they identified "the HST classification and teachers' ratings were more consistent in year 6 than year 3 students, probably reflecting more established handwriting patterns in the older students, on which teachers could base decisions about handwriting speed" (Wallen & Mackay, 1999, p. 39). Feder et al. (2007) supported this finding. They concluded the correlation between teacher ratings of handwriting and the ETCH-M scores was good ($r= 0.40\text{-}0.45$; $p<0.05$) (Feder et al.). Similarly, in a separate study, Feder et al. (2005) concluded that teachers ratings of handwriting performances of grade one children born preterm and typically developing peers illustrated an inverse relationship, where better teacher ratings were associated with better ETCH-M performance.

However, Sudsawad et al. (2001) identified that the correlation coefficients between the general legibility scores on the teachers' questionnaire and the scores of the ETCH total letter, word and numeral legibility were low and not significant. This trend was also observed using the ETCH subtest scores, in comparison to teachers' judgment of legibility on the same tasks as the ETCH; no significant relationship was found (Sudsawad et al.). Furthermore, Sudsawad et al. reported that teachers' judgment of handwriting legibility might be based on other components, other than legibility, such as the child's attention to details and writing attitude. These findings are supported by Daniel and Froude (1998) who concluded that although the intrarater reliability between

two independent teachers was high, the reliability between an independent teacher's and a classroom teacher's ratings of handwriting performance is poor to fair. Based on these results, Daniel and Froude speculated, "…there may be biases associated with a class teacher's evaluation of their student's handwriting" (1998, p. 55). However, regardless of these findings, fundamentally, the "teacher's evaluation of the quality of a child's handwriting, influences who is referred to occupational therapy" (Daniel & Froude, 1998, p. 49). Therefore, it is concluded that the "teacher's judgments are important in the social context" (Sudsawad et al., 2001, p. 522) and should be considered an influential outcome measure.

5.8.4 Summary: Teachers And Handwriting

The *occupational interactions* between the teacher and handwriting were identified within the literature sources. The literature illustrated the *structural* and *occupation*al *interactions* are foundational because the teacher primarily provides the introduction of handwriting to children. The literature sources illustrated consensus in the belief that handwriting should be taught, however the features of the instructional methods, were inconsistent. It was also identified within the literature that the *occupational forms* (teachers) responsible for the instruction of handwriting were not themselves instructed on handwriting (Kiss, 2007; Marr, 2001). The result illustrated varying opinions on whether handwriting should be evaluated by teachers. Primarily, teachers were identified to use non-standardized, subjective measures for handwriting evaluation (Hammerschmidt & Sudsawad, 2004). However, the validity of teachers' evaluation abilities was found to be inconsistent within the literature sources. This section presented the *occupational interaction* between one *occupational form* and *occupation factor*. The following section presented the literature findings on the *occupational interaction* between occupational therapists, teachers and handwriting.

5.8.5 Sub-Factor: Teachers, Occupational Therapists And Handwriting

This section presented the *occupational interaction* between the *occupational forms*: teacher, occupational therapist and the *occupation factors*, handwriting. The professional

roles of teachers and occupational therapists have been identified in the literature. The teachers are responsible for teaching handwriting (Judkins et al., 2009); they are product-orientated (Chu, 1997). Occupational therapists are responsible for refining the handwriting skills (Judkins et al.) through the identification of underlying problems found to impact handwriting skills, and the integration of solutions (Freeman et al. 2004), which "provide important opportunities for the child to master the skill of handwriting" (Chu, 1997, p. 514). Therefore, occupational therapists are process-orientated (Chu). Both, the teacher and the occupational therapist orientations, and a particular focus on collaboration, are necessary for the successful development and intervention of handwriting skills (Chu).

In a 2004 survey of teachers, 18% of teachers reported to refer to occupational therapy services for handwriting concerns, particularly for illegible handwriting (Hammerschmidt & Sudsawad). The remaining 82% of teachers, who did not refer to occupational therapy, chose to work on the handwriting problems within the classroom, or did not know that they could refer to occupational therapy services (Hammerschmidt & Sudsawad). This finding was supported by Bayona et al., (2006), whom identified that some teachers may employ handwriting strategies independent of a referral to occupational therapy.

The reason the teachers referred to occupational therapy was because the child was no longer making gains within the classroom (Hammerschmidt & Sudsawad, 2004). The identified expectation for a referral to occupational therapy was to improve the handwriting legibility and decrease the frustration children experience with handwriting. Miller et al. (2001) concluded in their retrospective chart review, occupational therapists servicing children with characteristics of developmental coordination disorder identified the primary reason for teacher referral was for fine motor skills, and secondarily, for handwriting concerns. Although, upon evaluation, even though a large proportion of children demonstrated multiple problems, handwriting was identified by the occupational therapists as the primary issue within the sample (Miller et al., 2001). Additionally, Daniel and Froude (1998) identified the interrater reliability between the classroom teachers', independent teachers', and occupational therapists' evaluation of handwriting,

demonstrated poor to fair agreement (ICC range= 0.38 to 0.54). Of the nineteen variables, identified to contribute to handwriting quality, teachers and occupational therapists only agreed on two variables: letter formation and letter size (Daniel and Froude). It was reasoned, "the subjectivity inherent in evaluating "quality" offers an explanation for the marked discrepancies seen in the results (Daniel & Froude, 1998, p. 54). The discrepancies identified between teachers and occupational therapists "…add weight to the argument that professional and theoretical understanding of the variables critical to handwriting quality needs to be addressed" (Daniel & Froude, 1998, p. 56).

As a result of these identified discrepancies, it is important for the occupational therapist to establish a well-defined consensus with the teacher, of what the teacher constitutes as poor fine motor skills, good and poor handwriting, the level of acceptability, and the expected outcome of occupational therapy intervention (Daniel & Froude, 1998; Hammerschmidt & Sudsawad, 2004). This is particularly important, because "if teacher and occupational therapy evaluations of handwriting quality differ, the risk of children being overlooked or incorrectly referred will limit the full potential and adequacy of occupational therapy services to children" (Daniel & Froude, 1998, p. 49).

It was also concluded in the literature sources, when teachers and occupational therapists collaborate, and the occupational therapist explicitly clarifies the functional problems and the expectations of intervention, the strategies provided are more effective (Bayona et al., 2006). Bayona et al. identified that when occupational therapy services were provided, those teachers who implemented handwriting strategies prior to occupational therapy involvement, found that the strategies were significantly more effective post consultation. This suggests that some teachers may require the support of the occupational therapist to implement strategies in a particular way to benefit the child and to highlight the benefits of the strategies (Bayona et al.). In Case-Smith's (2002) study determining the effectiveness of school-based occupational therapy, occupational therapists reported "communication with teachers [was] a critical element of the intervention" effectiveness (Case-Smith, 2002, p. 22).

5.8.6 Summary: Teachers, Occupational Therapists And Handwriting

The *occupational interactions* between the two *occupational forms*: teachers and occupational therapists, and handwriting were identified within the literature sources collected. Both of these professionals are involved with the occupation of handwriting, however the professional roles differ. Within the literature sources collected, two major themes were noted: establishing definitions and establishing collaboration were significant factors influencing the *occupational interactions*. The literature sources revealed that occupational therapists and teachers have differing definitions of: roles, service delivery, outcomes, legibility, handwriting performance issues, and evaluation methods. Clear definitions need to be established between the occupational therapist and the teacher prior to involvement, otherwise, the child is impacted. In the process of establishing these definitions, the collaboration between the two professionals begins. Collaboration between the teacher and the occupational therapist was reported in the literature to improve handwriting outcomes (Bayona et al., 2006; Case-Smith, 2002). This section established the *occupational interactions* between the occupational therapist, the teacher, and handwriting; the next section described the *occupational interaction* between the occupational therapist and handwriting.

5.8.7 Sub-Factor: Occupational Therapy And Handwriting

The literature sources collected on handwriting and occupational therapy were significant in quantity and quality. A comprehensive overview of the *occupational interaction* between the *occupational form* and the *occupation factor* as it was established within the literature, was provided. Specifically, the occupational therapy process of handwriting assessment and intervention was described within the remaining sections of this chapter. It was identified that specific sections established some of the conditions contributing to the occupational injustice. Therefore, extensive details from the literature sources were included to comprehensively illustrate the conditions. In consideration of the length and the details provided, three summaries were provided throughout this section instead of one at the end. The three sections included a general overview of the sub-factors: Occupational Therapy and Handwriting, followed by Occupational Therapy Assessment

of Handwriting, and concluding with Occupational Therapy and Handwriting Intervention.

The first sub-factor described the process of Occupational Therapy and Handwriting. A general overview was provided followed by occupational therapy service delivery models, and occupational therapy frameworks and protocols.

The majority of the occupational therapy literature sources indicated: handwriting and related fine motor challenges are the primary reasons for referral to occupational therapy in the schools (Benbow, 1995; Cermak, 1991; Chandler, 1994; Cunningham-Amundson & Crowe, 1993; Oliver, 1990; Reisman, 1991; Schneck & Henderson, 1990; Tseng & Cermak, 1993). Windsor (2000) concluded that "careful monitoring of children's early writing performance by knowledgeable occupational therapists may be important for early identification and possible prevention of later school difficulties" (p.19). Occupational therapists are seeing an increase in handwriting referrals because of the inconsistent and increasing lack of attention to formal handwriting instruction within the education system, differences in curriculum outcomes, teaching styles, and the complex multifactor nature of handwriting development in children (Judkins et al., 2009). Asher (2006) identified that "in schools, occupational therapists are often inundated with large numbers of referrals, reducing their ability to work effectively" (p.463). Additionally, the nature of the occupational therapy services available for students who experience handwriting problems across Canada is far from uniform (Freeman et al., 2004).

Occupational therapists possess the skills and expertise to comprehensively assess handwriting through the consideration of the various components (Chu, 1997; Wallen et al., 1996), and to make important contributions to handwriting interventions (Chu). It is an occupational therapist's role to ensure that the goals and objectives of handwriting interventions, which are determined in collaboration with the teacher (Chu), fit within the academic and curricular expectations, thus enhancing participation (Jewell, 1999). Jewel suggests that the occupational therapists that become more knowledgeable about written language will better serve the students referred them for handwriting challenges.

Woodward and Swinth (2002) documented, occupational therapy services need to go beyond the scope of the handwriting curriculum if children are to become proficient. Specifically, Freeman et al (2004) reported that occupational therapists need to support and advocate for the importance of handwriting in the curriculum by working with schools and on task forces, creating models for teaching handwriting across the school boards, providing in-services and after school clubs, and more research (Judkins et al., 2009). Occupational therapists play an integral role in the evaluation, intervention and advocacy of handwriting within the school system. This role is described further within the following sections of this chapter.

5.8.7.1 Occupational Therapy Service Delivery Models

Chu (1997) reported "providing occupational therapy services to children with handwriting dysfunction should be based primarily on the needs of the individual child" (p. 518). Furthermore, "therapeutic intervention in the form of direct service, consultation, and collaboration with the classroom teacher can help the students improve their handwriting" (Clark-Wentz, 1997, p. 33). In an American based survey regarding handwriting interventions, occupational therapists reported that 49.2% provide a direct service delivery model (individual or paired pull-out) (Woodward & Swinth, 2002). Similarly, in a Canadian based survey regarding the current trends in occupational therapy handwriting practices, Feder et al. (2000) identified that approximately half of the occupational therapists generally used a direct, one-to-one intervention model. The other half reported to use an indirect or consultative approach (Feder et al.). "This may be indicative of a move towards greater consultation and less hands-on treatment in clinical practice, particularly in the schools where caseloads tend to be high" (Feder et al., 2000, p.202). The benefits of each service delivery model was identified and described.

In the research study by Case-Smith (2002), she reported to use a direct model of intervention with students who were 7 to 10 years of age with poor handwriting legibility. Over the span of a year, the mean intervention duration was 32.2mins, while the mean number of sessions 16.4, for a total time average, 528mins (Case-Smith). After one year of receiving direct occupational therapy services, Case-Smith identified significant

improvements in in-hand manipulation and visual motor control compared to the control group. Additionally, Hammerschmidt and Sudsawad (2004) identified in their USA survey of teachers, over half of the teachers thought that the pullout model was the best service delivery method in comparison to a little over a quarter of the teachers reporting the consultation model of service delivery was the best method.

Whereas, Bayona et al. (2006) identified, when occupational therapists provided a combined service delivery model, which focused primarily on consultation, teachers and parents were the most satisfied with the opportunities for shared communication with the occupational therapists. Furthermore, occupational therapists reported statistically significant and practically meaningful improvements in the child's written communication (Bayona et al. 2006).

Alternatively, Kiss (2007) reported the major benefit of using a consultation model was that it illustrated to teachers and parents that occupational therapists consult on handwriting issues, they are not responsible for teaching it.

5.8.7.2 Occupational Therapy Handwriting Frameworks & Protocols

Three handwriting clinical decision-making tools for occupational therapists were reported in the literature sources: (1) Conceptual Model for Performance in Handwriting (Chu, 1997), (2) Handwriting Assessment Protocol-2nd edition (Pollock et al., 2009), (3) Tool for Optimizing Written Productivity (TOW-P) (Rigby & Schwellnus, 1999; Schwellnus & Lockhart, 2002; Schwellnus et al., 2009). The Conceptual Model for Performance in Handwriting (Chu) was identified to provide a conceptual framework for both the evaluation and treatment of children with handwriting difficulties. While the other two tools, described the decisions involved in evaluating handwriting difficulties (Pollock et al.), and the clinical-decisions required for providing appropriate handwriting intervention (Rigby & Schwellnus; Schwellnus & Lockhart; Schwellnus et al.). Each tool is distinguished by particular characteristics, which made all three tools unique.

The Conceptual Model for Performance in Handwriting (Chu, 1997), targeted children in mainstream education who have a developmental disorder (such as dyslexia; dysgraphia; dyspraxia; developmental coordination disorder; etcetera) and handwriting difficulties. Chu's framework guides an occupational therapist through the process of handwriting evaluation and intervention. Chu stated, "it is important for each occupational therapist to adopt a conceptual model of practice so that systematic evaluation and treatment programs can be implemented" (Chu, 1997, p. 515). The conceptual model outlines a systematic evaluation of the *performance components*: sensory, perceptual, praxis and motor functions; cognitive functions; and psychosocial functions, *performance areas*: productivity; leisure; and activities of daily living, within the *performance contexts*: temporal; and environmental aspects. This conceptual model is based on the philosophy that deficits within the performance components (i.e. visual motor skills), will affect the child's functional performance (i.e. handwriting skills), due to the "interactive relationship among performance areas, performance components and performance contexts" (Chu, 1997, p. 516). Chu stated, "function in performance areas within a specific set of performance contexts is the ultimate concern of occupational therapy" (Chu, 1997, p. 516).

Alternatively, the Handwriting Assessment Protocol- 2nd edition (Pollock et al. 2009), which may be accessed through the McMaster University CanChild website, is a free, printable resource for occupational therapists. The purpose of the protocol as reported by the authors is "to look at the occupation of handwriting" (Pollock et al. 2009, p. 3), while providing "direction in the identification of the specific areas of difficulty, thereby assisting in determining whether and where to intervene" (Pollock et al., 2009, p. 3). This tool reflects, "current evidence as well as current curriculum standards and expectations" (Pollock et al., 2009, p. 4). The Handwriting Assessment Protocol- 2nd edition, provides an occupational therapist with a methodical outline of the handwriting areas of assessment for children in grades SK-6, included in the sections: *Preliminary Information*, *Classroom Observations*, *Testing*, and *Analysis*. This tool identified both the functional domains and skills involved in the process of handwriting, while including

clinical decision-making guidelines. However, this tool does not provide a comprehensive assessment of the performance components involved in the process of handwriting.

The Handwriting Assessment Protocol-2nd edition was borne from the outdated *Protocol for the Assessment of Primary and Junior School-Aged Children* (Coulter, Pollock & Lockhart, 1994 cited in Pollock et al., 2009), which is commonly referred to as "The Blue Book" (Pollock et al.). Although Pollock et al. reported the original version is continually used as a reference tool, the Handwriting Assessment Protocol-2nd edition was reported to be a more acceptable tool for use. This is because (1) the research evidence referenced in the protocol is reported to be up to date, (2) in 2006; the first draft of the K-Grade 3 protocol was piloted tested and revised as a result, (3) in 2007 the protocol was pilot tested and revised again, for the purposes of clinical utility, (4) in 2009, the protocol included grades four to six and was pilot tested and integrated into the second edition (Pollock et al.).

The last tool identified within the literature, was the Tool for Optimizing Written Productivity (TOW-P). Three research studies, describing the development of the TOW-P methodology, have been published over the course of ten years (Rigby & Schwellnus, 1999; Schwellnus & Lockhart, 2002; Schwellnus et al., 2009). The TOW-P was designed as a decision guide to assist occupational therapists in using a holistic, client-centered approach to written productivity issues (Rigby & Schwellnus). This tool "includes both assessment areas and interventions frequently used by therapists in the treatment of children with challenges in written productivity" (Schwellnus et al., 2009, p. 205). The TOW-P provides therapists with broad descriptions and a framework to support the development of handwriting intervention plans; it "is not an assessment, intervention or outcome measure" (Schwellnus et al, 2009, p. 205). The TOW-P, was initially labeled, Occupational Therapy Decision Making Guidelines for Problems in Written Productivity (Rigby & Schwellnus). The revised name was introduced in Schwellnus and Lockhart (2002) and therefore, will only be referred to as this revised name.

The theoretical underpinning of the TOW-P is the Person, Environment, Occupation Model (PEO) (Law et al 1996 as cited in Schwellnus et al., 2009). It was identified that the complexities of handwriting dysfunction occurs in all three areas of the PEO. Schwellnus et al. reported the tool would systematically guide a clinician through the intricacy of the handwriting problems. For example, the assessment areas and corresponding interventions may include, but are not limited to: posture (assessment) and seating (intervention strategy), visual perception (assessment) and scanning tasks (intervention strategy) etcetera (Schwellnus & Lockhart, 2002). The TOW-P matrix, is reported to fit onto regular sized computer paper with the *Assessment Findings* across the top horizontal and the *Intervention Strategies* along the left vertical of the page (Schwellnus & Lockhart). The middle is comprised of boxed highlighted patterns, identifying the top most selected intervention strategies per assessment finding (Schwellnus & Lockhart). Although the methodology and outcomes of pilot testing the TOW-P were reported in the literature, no follow-up information, regarding the development status, costs, etcetera, were provided.

5.8.8 Summary: Occupational Therapy And Handwriting

The literature sources reviewed the occupational therapy service delivery models and frameworks related to handwriting. Handwriting is a major referral source for occupational therapists therefore the literature reported that knowledge on the components of handwriting and the educational outcomes are important (Jewel, 1999). The literature sources illustrated that regardless of the service delivery model, improvements in handwriting were observed after occupational therapy intervention. The literature sources also concluded, the consultation model is becoming the most typical model of service delivery (Feder et al., 2000), even though a majority of teachers report they preferred the pulled out model (Hammerschmidt & Sudsawad, 2004).

The three different decision-making tools (frameworks or protocols) for occupational therapy handwriting evaluation and intervention were reviewed. Two clinical decision-making tools described were tangible tools for the occupational therapist to obtain and

use. However, the no further information was available on the third tool, the Tool for Optimizing Written Productivity (TOW-P), using the search strategy reported in the methods section. While one tool provided a conceptual framework for evaluating and treating children with handwriting difficulties (Chu, 1997), the other two illustrated practical step-wise decision making tools for either the assessment of handwriting problems (Pollock et al., 2009) or for assisting occupational therapists in the decisions regarding suitable interventions for children with handwriting difficulties upon assessment (Rigby & Schwellnus, 1999; Schwellnus & Lockhart, 2002; Schwellnus et al., 2009).

Regardless of which clinical tool occupational therapists choose to use, the assessment process consisted of seven stages, which may vary in order, depending on the service delivery method or school environment: (1) review the clinical and or educational record, (2) discuss concerns with teacher, parent or other professionals involved, (3) examine handwriting samples, (4) observe child engaging in a functional handwriting activity within the natural context of the classroom, (5) complete a comprehensive assessment of the child's handwriting skills using grade appropriate assessment tools, (6) analyze the assessment findings, (7) provide individuals involved with a synopsis or summary of findings either through verbal report and or written documentation, (8) develop intervention plan based on assessment, including goals, recommendations and strategies (Chu, 1997; Pollock et al., 2009). A compilation of the literature on the assessment components of handwriting is included (See Table 5.1). The next section described the occupational therapy process of assessing handwriting in detail.

Table 5.1 Occupational Therapy Handwriting Assessment (Chu, 1997; Pollock et al., 2009)

GENERAL
Clinical and or educational record, Teacher, parent or other professional's concerns (occupational performance issue) Handwriting samples, Observe child in functional handwriting activity within the natural context
ENVIRONMENT

<table>
<tr><td colspan="2">Classroom workstation: furniture, distance from board, glare, room concept, contents in the room
Postural control: body posture, shoulder posture, forearm posture, hand and wrist posture
Behavioural observations
Workbook review</td></tr>
<tr><td colspan="2">PERFORMANCE AREA</td></tr>
<tr><td colspan="2">Writing from memory, copying: near point and far point, dictation, composition</td></tr>
<tr><td colspan="2">HANDWRITING COMPONENTS</td></tr>
<tr><td>Functional Components</td><td>Performance Components</td></tr>
<tr><td>Biomechanical And Ergonomic Factors

Pencil grasp, handedness, writing tools, pressure on paper, tension of grip, paper positioning, paper type, bilateral integration, postural background movement,</td><td>Sensorimotor components

Sensory processing functions, perceptual processing functions, postural-motor control, praxis</td></tr>
<tr><td>Handwriting Analysis

General: handwriting speed, general impression, consistency, readability, neatness

Writing Style: manuscript, or cursive writing

Writing Case: upper or lower case

Appearance: legibility, formation, alignment, size, space, slant, baseline use, curve formation, directionality, letter closure, letter orientation, joined up, ascenders/descenders, distortions, collisions,</td><td>Psychosocial components

Emotional stability, self esteem, motivation, self-control</td></tr>
<tr><td>Handwriting Analysis

Content: planning, ideation, sequencing, elaboration, cohesiveness, spelling, fluency, grammar, syntax, capitalization punctuation, consistency, proofreading</td><td>Cognitive components

Attention, memory, language (comprehension), reasoning</td></tr>
<tr><td colspan="2">OTHER</td></tr>
<tr><td colspan="2">Associated reactions, association movements, squirms and fidgets, vocalization, fatigue, frustration, resistance to task, impulsiveness, worried about mistakes, constant erasures, timid and nervous, hesitation, dislikes writing, avoidance.</td></tr>
</table>

5.8.9 Sub-Factor: Occupational Therapy Assessment Of Handwriting

The occupational therapy assessment process of handwriting was described. This included formal and informal assessment tools of the functional components and the

performance components, of handwriting. The literature sources revealed numerous studies that evaluated the psychometric properties and outcomes of the available occupational therapy assessment tools. The assessment tools, including their psychometric properties, were described in detail within this section.

The complexity and "pervasive effect of poor handwriting makes it important for therapists to seek a clear understanding of the nature of handwriting problems" (Malloy-Miller et al., 1995, p. 259). Occupational therapists may use a combination of formal and informal assessments and observation to determine the child's handwriting function, performance component skills (Chu, 1997). "Occupational therapists' selection of assessment tools appeared to be directly related to the main reason for referral, or to underlying performance components" (Miller et al., 2001, p.13).

Informal assessment methods for evaluating handwriting are critical within the overall assessment process (Feder et al., 2000). Informal assessment includes the initial evaluation of the student in the classroom including an observation of attention, behavior, seating, different handwriting tasks (Feder et al.), reviewing the child's writing, and interviewing the teacher (Clark-Wentz, 1997). This observation of the child within the classroom provides the occupational therapist with a better understanding of the environmental impact on the occupation of handwriting (Clark-Wentz) including the structure of the class, the teacher's instructional approach, and the location of the child's desk in relation to the board, windows or doors (Clark-Wentz). Feder et al. identified in their survey of the handwriting practices of Canadian occupational therapists, the importance of environment did not influence the assessment favored. However, the authors recommended that the environmental and psychosocial elements impacting handwriting be recognized, highlighted and addressed (Feder et al.).

Formal or standardized assessments provide an objective measure and quantitative scores of the child's handwriting performance (Feder et al., 2000). Therefore, these assessments are critical in the assessment process (Feder et al.). Bonder (1989) suggested, "standardized assessments often are used in determining eligibility for children to receive

services, documenting change, and serving as a communication tool among members of the educational team" (as cited in Diekema et al., 1998, p.249). However, standardized measurements "need to capture results consistent with performance in the social context…otherwise, "improvement" as identified by an objective, standardized tool measuring either therapeutic outcome or research outcome may not be valid and may mislead and generate inaccurate information" (Sudsawad et al., 2001, p.522). This finding was also supported by Dennis and Swinth (2001) who reported that, the tests of handwriting legibility "must be specific enough to produce reliable scores yet flexile enough to be useful in clinical settings" (p.181).

The assessment of performance components versus the evaluation of functional handwriting performance has also been debated within the literature. Traditionally, the occupational therapist emphasized and analyzed the sensorimotor and perceptual performance components versus the functional components of handwriting, to identify the foundational skills that may be associated with handwriting difficulty (Cornhill & Case-Smith, 1996; Jewell, 1999). Feder et al. (2000) identified that standardized handwriting assessments and informal methods of handwriting evaluation such as checklists were used by only a small number of [occupational therapists] (10% to 14% respectively)" (p. 200). The greatest proportion of occupational therapists reported to commonly use standardized assessments of performance components, including: the Developmental test of Visual Motor Integration (90%), Bruininks-Oseretsky Test of Motor Proficiency (74%), and the Test of Visual Perceptual Skills-Motor (74%) (Feder et al.). These findings were identical to the findings of Miller et al., (2001) who identified that if standardized assessments are used, occupational therapists frequently used the VMI, BOTMP and the TVPS. Feder et al. also identified occupational therapists "routinely (>90%) assessed gross/fine motor skills, perceptual skills, quality of movement and motor planning" (Feder et al, 2000, p. 200). And that only a small portion of occupational therapists assessed "…functional performance or handwriting itself in their evaluation" (Feder et al., 2000, p.200). Conversely, Miller et al. (2001) identified that 96.5% of children who exhibit characteristics of DCD, were assessed using informal assessments of handwriting.

The assessment of performance components versus the evaluation of functional components of handwriting performance has been criticized in the literature, suggesting that assessment of the performance components is an inappropriate substitute for functional assessment (Case-Smith, 2000 as cited in McGarrgle & Nelson, 2006; Windsor, 2000). Windsor concluded, "ecological validity and the emphasis on outcomes suggest that the best way to study handwriting is probably to look at handwriting; that is, letter production" (2000, p.19). Additionally, "function in performance areas within a specific set of performance contexts is the ultimate concern of occupational therapy" (Chu, 1997, p.516). Task analysis is used to evaluate which components of handwriting impact the functional skill development (Cornhill & Case-Smith, 1996).

Regardless of the assessment method, the literature indicated it is imperative for the occupational therapist to consider the utility and psychometric properties of the assessment or evaluation tools, particularly considering: the type of writing script (Duff & Goyen, 2010), scales versus standardized assessments (Feder et al., 2000), the strengths and limitations of the normative data, the reliability and validity (Amundson & Weil, 1996 as cited in Feder et al.), and the population the tool was standardized on (i.e. typically development versus atypical) (Tam et al., 2009). Furthermore, Case-Smith (2002) reported "students with delays often lose ground over time when standard scores are used or when compared with higher-level students" (p. 23). Therefore, the presence of disabilities may also impact if an assessment is used and what type is used. The literature found on the occupational therapy evaluations the functional components of handwriting performance and the assessment of the performance components were described further within the next two sections.

5.8.9.1 Functional Components Evaluation Tools

As described in *occupation factors* and in Table 4.1, the functional components of handwriting include the (1) handwriting analysis, including: legibility, formation, alignment, sizing, spacing and speed, etcetera, (2) biomechanical and ergonomic factors, including: grip, pressure, posture, etcetera, (3) Handwriting content, including: planning, spelling, punctuation, etcetera (Chu, 1997). Formal and informal evaluations of

handwriting have been identified within the literature. The evaluation tools were presented in alphabetical order, commencing with handwriting analysis: (a) evaluations of legibility/formation, (b) evaluations of speed; followed by biomechanical/ergonomic evaluations. No evaluations on handwriting content were identified within the literature review.

5.8.9.1.a Handwriting Analysis: Legibility And Formation

Alphabet Writing Task

Alphabet Writing Task (Berninger, Mizokawa, & Bragg, 1991; Berninger, Yates et al., 1992) was designed to assess a child's ability to write the lower-case letters of the alphabet from memory (Weintraub & Graham, 2000). This evaluation evaluates quality (incorrect formation, letter omission, improper sequencing, case confusion, script confusion and letter reversal or rotation) based on two scoring criteria: number of letters correctly printed in the first fifteen seconds and the number of letters printing correctly in all (Weintraub & Graham). The interrater reliability between two examiners was identified as 0.88 (for the first fifteen seconds) and 0.82 (number of correct letters printed in total) (Weintraub & Graham).

Error Recognition and Grading Scale (ERGS)

Error Recognition and Grading Scale (McCleskey, 2004) was designed "for students who have previously been instructed with cursive handwriting, but continue to struggle with legibility" (Shimel et al., 2009, p.175). Within the ERGS, every cursive letter is judged for legibility based on formation and readability (Shimel et al.). The psychometric properties of the ERGS have been established by Bloomer and Smith (2005); Gartrell, Montgomery and Simpson (2006); Robb and Einecke (2005) (as cited in Shimel et al.).

Evaluation Tool of Children's Handwriting (ETCH)

The Evaluation Tool of Children's Handwriting (Amundson, 1995) was designed to provide a "comprehensive protocol for evaluating handwriting and the challenges inherent in measuring legibility" (Diekema et al., 1998, p. 249). It was designed to assess the readability of student's handwriting using a global approach to legibility scoring (Duff

& Goyen, 2010). Schneck (1998) reported the ETCH-M "is a criterion-referenced tool with standard administration and scoring procedures" (p. 257). The ETCH has two evaluation forms: manuscript (ETCH-M) and cursive (ETCH-C) writing legibility and speed (Diekema et al.). Diekema et al. reported the ETCH-M takes twenty to thirty minutes to administer, and is administered individually. A variety of writing tasks are evaluated including, upper and lower case alphabet production and numeral writing from memory, both near and far point copying, dictation, and composition (Diekema et al.). The evaluation is based on: the legibility score, the qualitative information of the legibility components, and the mechanical aspects of producing written work (Diekema et al.).

The author of the ETCH (Amundson, 1995) published psychometric properties within the test manual for both ETCH-M and ETCH-C (as cited in Diekema et al., 1998). Psychometric testing of the ETCH-M or the ETCH-C was established within these sources: Dennis & Swinth, 2001; Diekema et al.; Duff & Goyen, 2010; Feder et al., 2007; Koziatek & Powell, 2002; Marr, 2005; Shimel et al., 2009; Sudsawad et al., 2001; Zwicker & Hadwin, 2009) and one source: Schneck (1998) discussed the clinical interpretation of Diekema et al.). The findings were reviewed and presented based on the evaluation forms: manuscript and cursive.

Psychometric testing of the ETCH-M was completed on children with handwriting problems in: grade one and two (Diekema et al., 1998); grade one (Sudsawad et al., 2001); one and two (Zwicker & Hadwin, 2009). Alternatively, the psychometric properties of the ETCH-M on typically developing children in: grade one (Feder et al., 2007); grade four (Dennis & Swinth, 2001), and kindergarten to grade three (Marr, 2005) were also established. Schneck (1998) reasoned that determining the test-retest reliability is important for therapists because it "helps us to know the expected stability of the assessment results over time when intervention has not been provided" (p.256). The results of the psychometric testing revealed inconsistencies across the literature findings.

The interclass coefficients of the test-retest reliability of the ETCH-M ranged from: (ICC= 0.77) for total letter legibility, (ICC= 0.71) for total word legibility and (ICC= 0.63) for total numeral legibility (Diekema et al., 1998). Illustrating moderate levels of test-retest reliability for the ETCH-M (Diekema et al.). Schneck (1998) reasoned that the instability of the findings might be due to the nature of the task, or the high variability of performance in young children. Dennis and Swinth's (2001) study of pencil grasp on handwriting legibility of differing writing lengths, the authors identified ETCH-M interrater reliability for letter legibility ranged from: 89% to 98.7%; word legibility ranged from: 86.7% to 100% on every fifth writing sample. Additionally, the authors identified the total percent agreement for letter legibility ranged from: 96.9% to 99.4%, and word legibility ranged from: 86.7% to 100%, indicating very good agreement (Dennis & Swinth). Marr (2005) established an interrater reliability on twenty handwriting samples between two evaluators as (r = 0.81) for total letter legibility. Whereas, Zwicker and Hadin (2009) established an interrater reliability of 0.93 for total letter legibility on thirty percent of samples selected randomly between the blinded principle investigator and second rater. Feder et al. (2007) established a cutoff of -1.5 SD to identify children with clinically relevant handwriting difficulties. However, Sudsawad et al. (2001) found no significant relationship of the ecological validity, between the ETCH-M subtask score and general score, and teachers' perceptions of the children's level of handwriting ability.

Schneck (1998) reasoned that "the ETCH measurement method for legibility is global, thus increasing the subjectivity of the scoring" (p.257). Similarly, Zwicker and Hadwin (2009) questioned the sensitivity of the ETCH to measure subtle changes because it is a global measure of legibility. Sudsawad et al. (2001) reported the scores received on the ETCH, "represent a one-time observation of handwriting legibility" (p. 522). Therefore, based on the psychometric properties established by Diekema et al. (1998), they suggest occupational therapists use the Total Letter and Total Word percentages of the ETCH-M because these are the most reliable scores for first and second grade students. Furthermore, because of the lower then desired test-retest reliability coefficients, Diekema et al. recommends that the ETCH-M should be used in conjunction with other

evaluation techniques and that the individual task scores are not recommended for use in determining legibility, for services or in documenting change over time.

Three sources: Duff and Goyen (2010); Koziatek and Powell (2002); Shimel et al., (2009) established psychometric properties of the ETCH-C. Typically developing grade three children (Shimel et al.), grade four children (Koziatek & Powell) and children with handwriting problems in grades five and six were included (Duff & Goyen).

Duff and Goyen (2010) identified moderate to high intrarater reliability for total letter legibility (ICC= 0.80), total word (ICC= 0.71) and total numeral (ICC= 0.55) of the ETCH-C. And, moderate to high interrater reliability was found for total letter legibility (ICC= 0.84), total word (ICC= 0.62) and total numeral (ICC= 0.57) (Duff & Goyen). Whereas, Shimel et al. (2009) identified that, the interrater reliability using Pearson coefficients show acceptable reliability (r= 0.79 for an experienced and inexperienced rater and r=0.84 between two experienced raters). Duff and Goyen identified low to moderate test-retest for the ETCH-C: total letter legibility (ICC= 0.61), total word (ICC= 0.65) and total numeral (ICC= 0.24). Duff and Goyen highlighted that the scores on the test-retest data "may have been artificially lowered because of their narrow spread" (2010, p. 44). Total Letter score of 92 and total word score of 85 indicated good discriminant validity, while a total numeral score of 95 to be fair discriminant validity (Duff & Goyen). Whereas, Koziatek and Powell (2002) identified ETCH-C cutoff scores were satisfactory and unsatisfactory (Total letter scores of 81% and total word scores of 75%, respectively). Duff and Goyen found good concurrent validity ($p<0.001$) of the ETCH-C Total letter score with Test of Legible Handwriting (TOHL) legibility quotient. Whereas, Koziatek and Powell identified, moderate concurrent validity of teacher's subjective grades of student's performances with the ETCH-C (Total letter r=0.65, Total Word r=0.61, respectively). Koziatek and Powell report that additional studies are needed to examine the concurrent validity and reliability before the current study's results can be generalized. Duff and Goyen's (2010) findings of the ETCH-C, lend support to Diekema et al., (1998) study findings that Total numeral scores showed unacceptable reliability and should not be used. They recommend that scores should always be interpreted as part of a

comprehensive evaluation, but, that the "ETCH-C gives good information regarding functional written communication in the class, which is useful in planning intervention" (Duff & Goyen, 2010, p. 44).

Graphomotor Task Instrument (GTI)

The Graphomotor Task Instrument (Carlson & Cunningham, 1990) was designed to "provide the child with simple pre-writing tasks appropriate for kindergarteners and requires a simple analysis of the results" (Oehler et al., 2000, p. 55). The tasks include drawing a line between two various sized boundaries, tracing: a dotted line, a dotted "O" and a "W", and name writing (Oehler et al.). Guidelines for scoring each test are provided. The psychometric properties of the GTI, were previously established by Carlson & Cunningham (1990).

Handwriting Evaluation Scale (HES)

The Handwriting Evaluation Scale (Malloy-Miller, 1985) was designed to measure a percentage of handwriting errors in children aged seven through to twelve years of age (Malloy-Miller et al., 1995). Errors are calculated based on two handwriting tasks: a short story generated by a picture stimulus written by the child, and copying of a short paragraph (Malloy-Miller et al.). Handwriting errors include: spacing within words, spacing between words, size of letters within words, size between words, baseline orientation, closure, and line quality; higher scores indicates more handwriting errors (Malloy-Miller et al.). The psychometric properties of the HES were previously established by Malloy-Miller (1985). Roberts et al. (2010) identified the interrater reliability between two occupational therapists scoring three handwriting samples using the HES. The Pearson's product-moment correlation ranged from 0.78 to 0.96 for the seven components on the HES, indicating good reliability (Roberts et al.).

Minnesota Handwriting Test aka Minnesota Handwriting Assessment (MHA)

The Minnesota Handwriting Test/ Assessment (Reisman, 1993, 1995) was designed to evaluate a children's handwriting in grades one and two (Cornhill & Case-Smith, 1996). (For the intentions of clarity, this test will be referred to by the last published name of the

assessment, the Minnesota Handwriting Assessment: MHA). This assessment requires the child to copy a near point stimulus of the sentence "quick brown fox jumped over the lazy dog" which is in mixed order, and then each letter is graded for legibility, form, alignment, size, space and rate (content legibility) (Cornhill & Case-Smith). Cornhill and Case-Smith included another criterion, which was established through personal communication with Reisman, which categorized children into two groups, good handwriting and poor handwriting. This was based on a total score of the quality rating categories, summed for a total of 170 (Cornhill & Case-Smith). The poor handwriting group was considered to be those who scored less then 150 (Cornhill & Case-Smith). Peterson and Nelson (2003) reported the "scoring of legibility requires judgment on the MHA because letter recognition is somewhat variable among raters" (p. 157). The psychometric properties of the MHA have been established and published by Reisman (1993) and Lilly (1987).

The interrater reliability of the MHA was established by eleven occupational therapy students in the study by Peterson and Nelson (2003). Test-retest reliability was established on the five variables (legibility, form, alignment, size, space) resulting in an ICC range: 0.73 to 0.99 suggesting good to almost perfect (Peterson & Nelson). Whereas, the ICC, for speed was: 0.65 (Peterson & Nelson). Cornhill and Case-Smith (1996) established the MHA is a valid test of handwriting performance due to the almost perfect agreement (98%) between the MHA and the teacher's evaluation of the students' handwriting skills.

Tam et al. (2009) identified, the MHA demonstrates the "greatest promise to evaluate the printing performance of children who have motor impairments in view of its acceptable levels of reliability, validity and emerging clinical utility for typically developing children" (p. 404). However, Tam et al. established, the interrater reliability of ten random samples of the MHA (original) (legibility, form, alignment, size and spacing subscales) completed by children ages 6years 1 month to 8 years 6months, with cerebral palsy, was less then acceptable. Therefore, an addendum to the MHA scoring methods (MHA-CP) was created "to reduce ambiguity in error scoring by providing additional

rules to clarify the MHA scoring criteria in all subscales" (Tam et al., 2009, p. 405). Tam et al. identified using the draft scoring rules, a second set of ten samples identified an interrater reliability exceeding ICC=0.9. Rater reliabilities of the MHA-CP with 95% confidence intervals were determined (Tam et al.). The results, of the study by Tam et al., indicated that, the interrater reliability and the intrarater reliability of the MHA-CP (legibility, form, alignment, size and spacing) exceeded 0.96 with a 95% confidence interval. The excellent rater reliabilities concludes that the revised assessment for children with cerebral palsy (MHA-CP) is a reliable tool for occupational therapists to use (Tam et al.).

Scale of Children's Readiness In PrinTing (SCRIPT)

The Scale of Children's Readiness In PrinTing (Weil & Amundson, 1994) was designed as a letterform-copying test (Marr & Cermak, 2003). Children are to copy all the lowercase letters of the alphabet, followed by eight uppercase letters (AKMNVWYZ) onto unlined paper (Daly et al., 2003). The psychometric properties were previously established and published by the authors of the SCRIPT (Weil & Amundson, 1994).

Marr et al. (2001) reported they were not able to establish the point-by-point reliability indentified by the authors of the SCRIPT, therefore, refined scoring parameters, which included the criterion from the Test of Copied and Dictated Writing (Windsor, 1995) were included. Using the refined parameters and a Pearson Correlation, out of ten tests, a 0.95 interrater reliability between the first and third authors was established. Marr and Cermak (2003) used the same refined parameters established by Marr et al. and also established a 0.95 interrater reliability between the first and second authors. Marr and Cermak identified the test-retest reliability, of two random samples, one week apart, to be 0.77.

School Function Assessment (SFA)

The School Function Assessment (Coster, Deeney, Haltiwanger, & Haley, 1998) was designed to "measure performance of children with disabilities on non-academic school tasks and activities" (Bayona et al., 2006, p. 98). The written work subscale includes

items such as "[the child] leaves appropriate spaces between words" (Bayona et al., 2006, p. 98). The psychometric properties of the SFA, have been previously established by Coster et al., (1998).

Test of Handwriting Skills (THS)

Test of Handwriting Skills (Gardner, 1998) was designed to test handwriting skills in both the manuscript and cursive writing of children, ages five to eleven years (Denton et al., 2006). Ten subtests obtain: memorized, dictated or copied stimuli of written numbers, letter or words (Denton et al.). The psychometric properties of the THS, have been previously established by Gardner (1998).

Test of Legible Handwriting (TOLH)

The Test of Legible Handwriting (Larsen & Hammill, 1989) was designed to measure the global legibility of students in grades 2-12 (Duff & Goyen, 2010; Rogers & Case-Smith, 2002). Any type of writing sample may be used and compared with one of three scoring guides for a rating score of 1 to 9 (Rogers & Case-Smith) because it is designed to assess the readability of student's handwriting (Duff & Goyen). Duff and Goyen found good concurrent validity ($p<0.001$) of the ETCH-C Total letter score with Test of Legible Handwriting (TOHL) legibility quotient.

Test of Written Language (TOWL)

Test of Written Language (Hammill & Larsen, 1983), specifically the handwriting subtest rating scale, "rates global legibility of a student's composition by comparing it with a series of graded specimens with a value ranging from 0 to 10, which is then standardized on a scale ranging from 0 to 20" (Roberts et al., 2010, p. 746). Roberts et al. defined the clinical indicator of success of handwriting improvement using the TOWL, was an increase of 3.0 points.

Vineland Adaptive Behavior Scales-Class Room Edition (VABS-C)

The Vineland Adaptive Behavior Scales-Class Room Edition (Sparrow et al., 1984) was designed to assess "adaptive function in the areas of communication, daily living skills,

socialization and motor skills for children between three years and 12years, 11 months (Bayona et al., 2006, p. 97). A subscale of the VABS-C measures written communication, such as "[the child] prints or writes own first and last name" (Bayona et al., 2006, p. 96). The psychometric properties, have been previously established by King et al. (1998, 1999), Sparrow et al. (1984) (as cited in Bayona et al.).

Informal Assessment of Legibility

Various authors have described informal assessments of handwriting legibility, quality-rating scales of handwriting, teacher/parent handwriting questionnaires, or handwriting evaluations (Daniel & Froude, 1998; DuBois et al, 2004; Duff & Goyen, 2010; Marr & Dimeo, 2006; Roberts et al., 2010; Schilling et al., 2003; Sudsawad et al., 2001; Sudsawad et al., 2002). Wallen, Goyen and Duff (2007) point out in a critically appraised paper; therapists must be critical of results obtained from teacher questionnaires, if the reliability and validity of these questionnaires are unknown.

Cursive Practice and Review work sheet (Koziatek & Powell, 2002) was developed for Koziatek and Powell's (2002) research study, and pilot tested in 1999. This evaluation of cursive handwriting included a near-point copying sentence, manuscript-to cursive transition section and a composition of a five-word sentence in cursive writing (Koziatek & Powell).

Word Form Width (Marr, Windsor & Cermak, 2001) was developed and used within the (2001) research study by Marr, Windsor and Cermak (2001). Children aged 4 years 11months to 6 years 7 months, printed five dictated words on unlined paper (Marr et al.). The words were developmentally appropriate, spoken and spelled (Marr et al.). It was specified that, the word width was measured (in millimeters) only if all letters within the word met the specific measurement criteria (Marr et al.).

Writing Skills 2 (McGarrigle & Nelson, 2006) informally evaluated handwriting skills, and was created for McGarrigle and Nelson's (2006) research study. The writing skills included: tracing, copying and handwriting alphabet sampling: write name, writing

alphabet (memory for both) and copying a three-word sentence, based on yes (1 score) or no (0 score) ratings (McGarrigle & Nelson).

Personal Satisfaction With Handwriting

Roberts et al. (2010) were the only known authors identified in all of the seventy-five occupational therapy literature sources on handwriting, to include child-based evaluations, of personal satisfaction of handwriting skills.

The Attitude Scale (Roberts, Seiver, & Mair, 2010) was developed specifically for Roberts et al. (2010) research study. A semantic differential of seven pairs of adjectives, specific to handwriting, were provided to children in grades four to six (Roberts et al.). The child is to place an "X" response over the adjective, which best suited the child's perception of his/ her handwriting skills (Roberts et al.). The total score ranged from 7 to 49 points (Roberts et al.). The Attitude scale was piloted on 122 Grades 5 and 6 students and "successfully showed a range in responses for each question" (Roberts et al., 2010, p. 747).

The Student Inventory (Alberta Children's Hospital, 2001) "is a non-standardized attitude scale that includes eight questions, each with five pictures that range from a picture of a very happy dog (rated as 1) to one of a very unhappy dog (rated as 5) (Roberts et al., 2010, p. 747). Children were required to rate how they feel about their handwriting neatness. (Roberts et al.).

5.8.9.1.b Handwriting Analysis: Speed/Rate

Handwriting Performance Test (HPT)

The Handwriting Performance Test (Ziviani & Elkins, 1984) was designed to assess handwriting speed. Children are given a two minute period to copy the phrase "cat and dog" as quickly as they can without stopping to correct errors (Ziviani & Watson-Will, 1998). The intraclass correlation coefficient of 0.99 was established as the interrater reliability (Ziviani & Watson-Will).

Handwriting Speed Test (HST)

The Handwriting Speed Test (Wallen, Bonney, & Lennox, 1996) was designed to "provide an up-to-date and objective means of evaluating the handwriting speed of students presenting with handwriting difficulties" (Wallen et al., 1996, p. 281). The handwriting speed is established on the copying of a familiar short sentence "The quick brown fox jumps over the lazy dog" (Wallen and Mackay, 1999). This tool is useful for children years three to twelve, with physical or learning disabilities, or those children who have handwriting challenges (Wallen et al.). Wallen et al., report the HST may be completed in a whole group class setting or individualized setting. Children are asked to copy the common sentence as many times as they can in a three-minute period (Wallen et al., 1996; Wallen & Mackay). The letters per minute score was achieved by dividing the sum of the letters by three (Wallen et al.). Test administration, specified scoring criteria, interpretation and examples are provided within the test manual (Wallen et al.; Wallen & Mackay).

The interrater reliability of the Handwriting Speed Test, was established by Wallen et al. (1996) and Wallen & Mackay (1999). The normative samples were from New South Wales, Australia, and included: a representative of the population of children in years 3 to 6, years, 7 to 9, and years 10 to 12 (Wallen et al.) and students in year 3 and year 6, (Wallen & Mackay). The authors determined the interrater reliability for the whole sample was excellent (ICC of 1.00 ($P<0.0001$) and for each school year was also excellent, (ICC of 0.999 to 1.00 ($P<0.0001$) (Wallen et al.). Wallen et al. identified, complete agreement between the raters occurred sixty five percent of the time (108 samples). Similarly, Wallen and Mackay identified that the raters scored 88% of the samples using the HST identically. Interrater reliability for the whole sample was high (mean ICC= 0.99) (Wallen & Mackay). Additionally, the authors found the intrarater reliability was also high for the whole sample (mean ICC= 0.999) (Wallen & Mackay). Four weeks after initial testing, Wallen and Mackay identified good test retest reliability for the whole sample (ICC= 0.898), and moderate to good for the various years and speed of handwriters (ICC= 0.717 and 0.916). The authors suggested that the HST is a useful tool applicable for a wide age range, and should be "used as part of a multifaceted

assessment of handwriting, which includes other standardized assessments and clinical observations" (Wallen & Mackay, 1999, p. 41).

Informal Evaluation of Speed

Informal evaluations of a child's handwriting speed may include: memorizing and printing a common phrase, "the quick brown fox jumps over the lazy dog" (Sovik, 1975 as cited in Roberts et al, 2010) or printing the alphabet from memory continuously for two minutes (Malloy-Miller et al., 1995). Wallen et al. (1996) identified when three minutes is provided, "the number of discrepancies is greatly reduced" (p. 285). Rogers and Case-Smith (2002) informally assessed cursive handwriting speed using a modified version of Twinkle Twinkle Little Star. Children were to write in their usual manner for a two-minute duration (Rogers & Case-Smith).

5.8.9.1.c Biomechanical/Ergonomic Evaluations

The biomechanical and ergonomic evaluations identified within the literature were documented within this section. A majority of the literature sources explored the evaluation of grasp.

Grasp

Handwriting is a complex skill that requires the efficient use of a pen or pencil, manipulated by the interphalangeal joints of the fingers and thumb in the writing hand (Summers, 2001). A child's pencil grasp and the impacts of grip were identified within these literature sources: Burton and Dancisak, (2000); Chau et al. (2006); Dennis and Swinth (2001); Koziatek and Powell (2003); Summers (2001); Windsor (2000); Yakimishyn and Magill-Evans (2002).

The literature indicated there are two general types of grip assessment systems: component and whole configuration (Burton & Dancisak, 2000). The component assessment, analyzes the grasp in components, including the fingers, thumb, pencil, wrist and forearm position in relation to the desk (Burton & Dancisak). The whole configuration system, categorizes general grasp patterns using a distinctive label with predefined descriptive definitions (Burton & Dancisak).

Grasp Classification Systems

Schneck and Henderson's (1990) developmental grip scale, describes 10 pencil and crayon grips (Yakimishyn & Magill-Evans, 2002). The scale was normed on three hundred and twenty, typically developing children 3 to 6 years of age (Dennis & Swinth, 2001). The scale is divided into "primitive", "transitional" and "mature" grips (Yakimishyn & Magill-Evans). The first five grip descriptions were labeled as primitive grips, "because they were rarely observed after four years of age" (Burton & Dancisak, 2000, p.10). The next three grip descriptions were labeled as transitional "because their use decreased with age but still continued into the 6th year" (Burton & Dancisak, 2000, p. 10). Lastly, the final two grip descriptions were labeled mature "because their use increased with age" (Burton & Dancisak, 2000, p. 10). The psychometric properties of this system have been established (Burton & Dancisak; Schneck & Henderson, 1990; Tseng, 1998). Burton and Dancisak yielded a 0.75 intrarater proportion of perfect agreement in re-recording coded trials of grip classification. Interrater proportion of perfect agreement was 0.67 (Burton & Dancisak).

Schneck (1991) "found differences in grasp between children with good and poor handwriting, as rated by classroom teachers" (as cited in Dennis & Swinth, 2001, p. 177). Schneck created a revised five-point scale, which ranked the grasps from mature (level 5) to immature or primitive (level 1) (as cited in Dennis & Swinth). Schneck and Henderson's (1990) ten levels were converted into Schneck's (1991) five level grip classification. Burton and Dancisak (2000) established a 0.87 intrarater proportion of perfect agreement (kappa of 0.75). Additionally, a 0.80 (kappa of 0.64) interrater proportion of perfect agreement was established (Burton & Dancisak).

Tseng's (1998) classification system added three grasps to the primitive category and included the quadrupod grasp as a mature grasp, for a total of fourteen recorded grasp patterns (as cited in Yakimishyn & Magill-Evans, 2002). Koziatek and Powell (2003) established a 76% agreement of pencil grip classifications between the researcher and another occupational therapist.

The psychometric properties of a combined classification system: Schneck and Henderson (1990) and Tseng (1998) were established (Yakimishyn & Magill-Evans, 2002). Interrater reliability between two occupational therapists was found to be 90.1%. Intrarater reliability, two months later, was double-coded with a 95.1% agreement (Yakimishyn & Magill-Evans).

Alternatively, Erhardt (1994) developed a typical grasp pattern progression from one through to six years of age (as cited in Dennis & Swinth, 2001). Using Erhardt's (1994) progression, children's grasp patterns are observed to evolve from: palmar supinate grasp, to digital pronate grasp, to static then dynamic, tripod grasp (as cited in Dennis & Swinth). The research study by Dennis & Swinth contributed to the grip classification systems, because two grasps were observed and described which had not been previously described: lateral quadropod grasp and the tripod grasp without webspace.

Instrumentation System

The Instrumentation System (Chau et al., 2006) was designed and developed as a "noninvasive instrumentation system that uniquely records grip forces exerted on the writing utensil along with typical temporal and kinematic parameters" (Chau et al., 2006, p. 1542). The system was constructed from materials that were relatively accessible, off the shelf, hardware (Chau et al.). This system was designed to record the grip forces, to provide process-related information regarding the graphomotor skills required in handwriting (Chau et al.). The use of the instrumentation system indicated that (1) the "grip force and normal force appear to be correlated (r=.67 in this example)" (Chau et al., 2006, p. 1545), meaning the pressure of the fingers on the pencil and the pressure of the pencil on the paper are correlated (Chau et al.). (2) The "normal force appears to lag the grip force" (Chau et al., 2006, p. 1545), meaning children adjust their grasp before placing the pencil on the paper (Chau et al.). (3) The "total barrel force is much larger then normal force"(Chau et al., 2006, p. 1545). Suggesting that while a child is printing, more energy is used to hold the pencil then to place and press it to the paper (Chau et al.).

Torque Range of Motion (TROM)

The Torque Range of Motion (Summers, 2001) was designed for the research study conducted by Summers (2001). The TROM was used as "a technique in which a constant force is applied distally to a joint being measured with a goniometer" (Summers, 2001, p. 134). This technique allowed one assessor to reliably measure and compare joint extension when the applied force was constant (Summers). Test-retest reliability of the TROM piloted on twelve children, on two occasions, with three hour intervals in-between, demonstrated good to high agreement (ICC= 1 and 1 respectively), index DIP= 0.88; thumb IP= 0.89; thumb MP= 0.97 (Summers). The study results illustrated a test-retest index DIP= 0.77; thumb IP: 0.89 and thumb MP= 0.9 (Summers).

Informal Evaluation of Biomechanical/ergonomic factors

Writing Skills 1 (McGarrigle & Nelson, 2006), an informal, non-standardized, handwriting measure for grade one students, was developed by McGarrigle and Nelson for use within their (2006) research study. Writing Skills 1 assesses: sitting posture, pencil grasp, pencil pressure, paper stabilization/ positioning (McGarrigle & Nelson). These skills were rated on a scale of 0-3, where (0= never) and (3=always) (McGarrigle & Nelson).

5.8.9.2 Performance Component Assessment Tools

The performance component assessments identified in the literature were presented within this section. Assessments were categorized and presented alphabetically.

Bruininks-Oseretsky Test of Motor Proficiency (BOTMP)

The Bruininks-Oseretsky Test of Motor Proficiency (Bruininks, 1978) was designed to assess the fine and gross motor skills of children ages four and a half to fourteen and a half years of age (Malloy-Miller et al., 1995). Tests are divided into fine and gross motor subtests (Malloy-Miller et al.). The psychometric properties have been previously established (Bruininks, 1978 as cited in Malloy-Miller et al.).

Feder et al. (2007) identified moderate correlations of writing legibility on the ETCH-M with the BOTMP Visual motor control; subtest (r= 0.36 to r=0.40). However "further research is needed to confirm this association" (Feder et al., 2007, p. 57). Malloy-Miller et al. (1995) identified that the BOTMP fine motor composite, significantly correlated (r= -0.37; $p<0.01$) with the aiming writing factor (baseline orientation). Case-Smith (2002) identified improvements in grade two, three and four children's visual motor control (BOTMP) was observed, from pre-post intervention, however, no correlation analysis of handwriting skills to visual motor control was completed.

Colorado Perceptual Speed Test (CPS)

The Colorado Perceptual Speed Test (Decker & DeFries, 1981) was designed to assess a child's ability to match alphanumeric symbols within a timed test (Weintraub & Graham, 2000). The psychometric properties of this assessment were previously established (Berninger, Cartwright, Yates, Swanson, & Abbott, 1993 as cited in Weintraub & Graham). Weintraub and Graham established an interrater reliability of 0.96.

Developmental Test of Visual-Motor Integration (VMI)

The Developmental Test of Visual-Motor Integration (Beery & Buktenica, 1989; Beery, 1997; Beery & Beery, 2004) is designed to assess the visual-motor integration of children ages two to fifteen years of age (Malloy-Miller et al., 1995). Children are provided with a booklet comprised of 27 geometric forms that they are to near point, copy (Malloy-Miller et al.). Beery and Beery (2004) reported, "children able to copy the first eight designs are thought to be ready for handwriting instruction" (as cited in Zwicker & Hadwin, 2009, p. 43). A higher score indicates greater visual-motor integration skills (Malloy-Miller et al.). The test is available in short and long form, which varies on the number of geometric shapes presented in progressively greater complexity (Daly et al., 2003). Psychometric testing has been completed (Beery & Buktenica, 1989 as cited in Cornhill & Case-Smith, 1996; and Beery, 1997 as cited in Marr et al., 2001). Marr et al. established inter-coder agreement was 0.97 using a Pearson correlation between the first author and another occupational therapist, on ten student tests.

Goyen and Duff (2005) concluded, "the relationship between handwriting and underlying abilities beyond the writing readiness stage remains inconclusive" (p. 112). The discriminant validity of the VMI, in relation to grades 4-6 children with handwriting dysfunction, was determined (Goyen & Duff). Children, who score below one standard deviation from the mean on the VMI, are considered below the normal range; therefore this was determined the cut-off point for the VMI (Goyen & Duff). The results identified, although the VMI illustrated reasonable specificity (86% of children in the control group were identified correct), low sensitivity was identified (34% of children were correctly identified with poor handwriting) (Goyen & Duff). Therefore, although the VMI is a successful tool for identifying visual motor challenges, "it is not appropriate for use as a diagnostic tool of handwriting dysfunction" (Goyen & Duff, 2005, p. 112). Goyen and Duff also state that it is inappropriate to routinely use the VMI to make causal inferences regarding handwriting skills in children with handwriting dysfunction. This finding was also supported by Feder et al. (2007). Additionally, grade one students in McGarrigle and Nelson's (2006) study did not show significant improvements as measured by the VMI, although functional improvements were observed in handwriting; no correlational analysis was completed.

Conversely, Cornhill and Case-Smith (1996) identified that the VMI was a significant predictor of handwriting performances of typically developing first grade students ($p<0.001$). Cornhill and Case-Smith suggested the "VMI is a strong predictor of handwriting skill at a variety of ages and that a child's skill in copying forms has a strong relationship to handwriting" (1996, p. 737). Marr et al. (2001) identified over the course of one year, typically developing kindergarten students demonstrated statistically significant improvements on the VMI and that a moderate relationship between the SCRIPT and the VMI ($r = 0.36$) was identified. This suggested a relationship exists between visuomotor and graphomotor skills (Marr et al.). Marr et al. recommended that for typically developing kindergarten children "evaluating visuomotor skills may help pinpoint children who need close monitoring or specific interventions to prevent the development of handwriting problems" (2001, p. 14). Weintraub and Graham (2000) identified that visual motor integration significantly contributed to the prediction of the

handwriting performance (good or poor) of grade five students. This finding was also supported by Daly et al. (2003) who identified that, the scores on the VMI demonstrated a strong relationship with the ability to copy letters on the SCRIPT (Pearson r= 0.64) in typically developing kindergarten students. Daly et al. identified that a kindergarten student's ability to copy the first nine forms on the VMI, would demonstrate superior handwriting legibility on the SCRIPT (p<0.001). Therefore, the author's findings "support the conclusion that the VMI was a useful screening tool for handwriting abilities, thereby noting visual-motor integration as a requisite skill for handwriting legibility" (Daly et al., 2003, p. 461). Malloy-Miller et al. (1995) identified that the VMI significantly correlated (r= -0.37; p<0.01) with execution/coordination writing factors, including: line quality, closure, and size relation of letters within words. Additionally, Malloy-Miller et al. identified that the VMI significantly correlated (r= -0.38; p<0.01) with the aiming writing factor (baseline orientation). Therefore, Malloy-Miller et al. suggested that children might not be developmentally ready when "unsteady handwriting" marked by challenges with execution/coordination, and aiming is observed.

Developmental Test of Visual Perception (DTVP-2)

The Developmental Test of Visual Perception (Hammill, Pearson, & Voress, 1993) was designed to assess four to ten year old children's position in space, figure ground perception and copying abilities (Case-Smith, 2002). The psychometric properties have been previously established (Hammill et al., 1993). Case-Smith identified improvements in grade two, three and four children's position in space were observed from pre-post intervention, however, no correlation analysis of handwriting skills to scores of position in space were completed.

Expressive Orthographic Coding

Expressive Orthographic Coding (Berninger, Cartwright, Yates, Swanson, & Abbott, 1993) was designed to assess a child's ability to visually memorize and recall nonwords and "reproduce the whole unit (whole-word coding) or specific letter (letter coding), or letter sequence in a designated order (letter-cluster coding)" (Weintraub & Graham, 2000, p. 127). The psychometric properties of this assessment, was previously established by Berninger et al. (1993). Weintraub and Graham yielded an interrater reliability of 0.94.

Finger Function Tasks

Finger Function Composite Score is a composition of the scores on the Finger Succession, Finger Lifting and Finger Recognition (Weintraub & Graham, 2000). The psychometric properties have been established (Berninger & Rutberg, 1992 as cited in Weintraub and Graham)

Finger Succession (Berninger & Rutber, 1992; Denckla, 1973, 1974) requires the child to "touch the thumb with each of their fingers in sequential order, beginning with the little finger and moving to the index finger, as quickly as possible until told to stop (after five cycles)" (Weintraub & Graham, 2000, p. 128). Children complete this assessment with the dominant hand, although both hands are held out of peripheral vision (Weintraub & Graham). Examiner models the movement and practice trails are given until child understands the instructions (Weintraub & Graham). Scoring was based on the number of seconds to complete five cycles (Weintraub & Graham).

Finger Lifting (Berninger & Rutber, 1992; Wolff, Gunnoe, & Gohen, 1983) requires the child to place his/ her hands onto the table while the examiner touches specific fingers, in a specific order, with a pencil eraser (Weintraub & Graham). Children are to raise the finger when "touched in the specified order (right middle finger, left ring finger, right ring fingerm left middle finger)" (Weintraub & Graham, 2000, p. 128). Correct lifting of the finger scores a point of 1 (Weintraub & Graham).

Finger Recognition (Berninger & Rutber, 1992; Fletcher, Taylor, Morris & Satz, 1982) requires a child to place a hand through a vision occluded screen, the examiner touches one finger with a paper clip, the screen is removed and the child informs the examiner which finger was touched (Weintraub & Graham). One point is given for each correct answer, for a total of five points per hand (Weintraub & Graham). This test is akin to the *Southern California Sensory Integration Test of Finger Identification* (Ayres, 1972 as cited in Malloy-Miller, et al., 1995).

Weintraub and Graham (2000) combined *finger recognition* and *finger lifting* to form a composite score of *finger function*. Based on these combined tasks, Weintraub and

Graham identified that *finger function*, significantly contributed to the prediction of the handwriting performance of grade five students. Furthermore, the authors identified that the knowledge of the student's finger function, visual-motor integration skills and gender combined, correctly predicted 77% of the students in grade five as good or poor handwriters (Weintraub & Graham). The authors suggested that "the present study extends the findings from previous research by showing that both visual-motor processes and finger functioning continued to be related to handwriting legibility"(Weintraub & Graham, 2000, p. 133) for students in grade five.

In-Hand Manipulation

Formal and informal assessments of in-hand manipulation skills have been documented by various sources. Although the names of the assessments may vary, the principles for assessment are consistent. The assessments found in the literature include: In-Hand Manipulation Skill Test (Exner, 1992 as cited in Feder et al., 2007); In-Hand Manipulation: IHM (Pehoski, Henderson & Tickle-Degnen, 1997a, 1997b as cited in Denton et al., 2006); and an informal assessment of in-hand manipulation (Case-Smith, 2002; Cornhill & Case-Smith, 1996). Generally, the assessment is designed to assess the time required to complete simple rotation and translation tasks using the dominant hand and a peg board (as cited in Feder et al.; Cornhill & Case-Smith) as well as specifics in finger to palm translation and palm to finger translation (Pehoski et al.). Translation involved recording the amount of time it took the child to pick up a specific amount of pegs (two to five pegs) (Cornhill & Case-Smith). The sums of the time were calculated for a total score (Cornhill & Case-Smith). Cornhill and Case-Smith described the assessment of rotation, which requires a child to pick up one of the five pegs, rotate it, and place it back into the original hole. The sum of the times were calculated (Cornhill & Case-Smith). The psychometric properties for the IHM have been established (Pehoski et al., 1997a, 1997b as cited in Denton et al., 2006).

Cornhill and Case-Smith (1996) identified that the correlation of in-hand manipulation skills (translation and rotation) and handwriting scores of typically developing first grade students were moderate to high, and both translation and rotation predicted handwriting

performance. The authors suggested, "efficient production of letters is related to coordinated muscle action and accurate use of force, such as that observed in object manipulation within the hand" (Cornhill & Case-Smith, 1996, p. 738). This is consistent with the findings by Feder et al. (2007), whom identified that there were modest associations between in-hand translation and alphabet writing speed, letter legibility and rotation, and letter/legibility. Case-Smith (2002) identified improvements in children's in-hand manipulation skills in grade two, three, and four, were observed from pre-post intervention, however, no correlation analysis of handwriting skills to in-hand manipulation skills was completed.

Kinesthetic Sensitivity Test

The Kinesthetic Sensitivity Test (Laszlo & Bairstow, 1985) was designed to measure the two components of kinesthetic function: kinesthetic acuity, and kinesthetic perception and memory (as cited in Malloy-Miller et al., 1995). Kinesthetic acuity is tested by passively moving a child's hands up and down runways with vision occluded (Malloy-Miller et al.). The minimum difference between the angles is recorded as the score (Malloy-Miller et al.). Alternatively, kinesthetic perception requires "the subject to restore a displayed pattern to the orientation the pattern had been when previously traced with vision occluded" (Malloy-Miller et al., 1995, p. 261). Higher scores indicate more difficulty (Malloy-Miller et al.).

Motor Accuracy Test (MAC)

The Motor Accuracy Test (Ayres, 1980) is a tracing activity, which measures the motor accuracy and sensorimotor coordination in the arms and hands whilst tracing (as cited in Cornhill & Case-Smith, 1996; Feder et al., 2007). The psychometric properties have been previously established (Ayres, Mailloux, & Wendler, 1987 as cited in Feder et al.).

Cornhill and Case-Smith (1996) established that the correlation between the MAC and the MHA scores were moderate (r=0.594) for predicting good from poor handwriters of typically developing first grade students. Cornhill and Case-Smith suggests, "eye-hand coordination skill is a fundamental component of handwriting and should be evaluated

when handwriting legibility is low" (1996, p. 737). Conversely, Feder et al. identified that the MAC and ETCH-M did not demonstrate a significant association for typically developing grade one children.

Motor-Free Visual Perception Test (MVPT)

The Motor-Free Visual Perception Test (Colarusso & Hammill, 1983) was designed to assess the visual perceptual skills of children aged 4 to 8 years of age (Malloy-Miller et al., 1995). Children are required to match a shape, to a visual model (Malloy-Miller et al.). Lower scores represent more challenges completing the test (Malloy-Miller, et al.).

Southern California Sensory Integration Test of Kinesthesia (SCSIT of Kinesthesia)

The Southern California Sensory Integration Test of Kinesthesia (Ayres, 1972) was designed to assess the child's ability to duplicate the position and movement of the hand and arm which are passively guided with vision occluded (Malloy-Miller et al., 1995). This test was designed for children ages 4.0 years to 8.11 years; lower scores indicate greater difficulties (Malloy-Miller et al.).

Malloy-Miller et al. identified that the SCSIT of Kinesthesia significantly correlated ($r = -0.39$; $p<0.01$) with execution/coordination writing factors, including: line quality, closure, and size relation of letters within words.

Southern California Sensory Integration Test of Finger Identification (SCSIT of FI)

The Southern California Sensory Integration Test of Finger Identification or "Finger Identification" (Ayres, 1972) was designed to assess children's basic tactile sensory awareness to be able to identify which finger was touched when vision was occluded (Malloy-Miller et al., 1995). This test was designed for children ages 4.0 to 8.11. Lower scores indicate greater difficulty (Malloy-Miller et al.). Psychometric properties of this assessment have been previously established (Ayres, 1966 as cited in Feder et al., 2007).

This test is akin to *Finger Recognition* (Berninger & Rutber, 1992; Fletcher, Taylor, Morris & Satz, 1982 as cited in Weintraub & Graham, 2000). Feder et al. (2007) did not

observe a significant relationship between the Finger Identification test and the ETCH-M (legibility or speed) for typically developing, grade one students. This contrasts Weintraub and Graham's findings (see Finger Function Composite). It also contrasts with Malloy-Miller et al. study findings, which identified that the SCIST of FI significantly correlated ($r= -0.35$; $p<0.01$) with execution/coordination writing factors, including: line quality, closure, and size relation of letters within words.

Steadiness Test

Steadiness Test (Birhbaum et al., 1999) was designed to assess the upper extremity steadiness in the dominant hand (as cited in Feder et al., 2007). Children place a stylus into a metal grid with graded circular openings, and try to hold it there without touching the sides of the metal grid (Feder et al.). Psychometric properties have been established (Birnbaum et al., 1999 as cited in Feder et al.). Feder et al. identified an association between the Steadiness Test and findings on the ETCH-M "suggesting that upper extremity stability may play a role in legible handwriting" (2007, p. 58).

Test of Manual Pointing (TMP)

The Test of Manual Pointing (von Hofsten & Rösblad, 1988) was designed to "measure proprioception in children 4 to 12 years of age" (Denton et al., 2006, p. 19). The assessment requires a child to place a pushpin under a table depending on four conditions (Denton et al.). The distance from the target is calculated (Denton et al.).

Test of Visual-Perceptual Skills-Non Motor (TVPS)

Test of Visual-Perceptual Skills-Non Motor (Gardner, 1982) "evaluates strengths and weaknesses of children aged 4 to 13 in seven component areas (visual discrimination, visual memory, visual-spatial relationships, visual form constancy, visual sequential memory, visual figure-ground, and visual closure)" (Feder et al., 2007, p. 49). The psychometric properties of this assessment have been previously established (Gardner, 1982). Feder et al. identified moderate correlations between word legibility, lower case alphabet writing speed as measured on the ETCH-M and the TVPS scores for typically developing grade one students.

5.8.10 Summary: Occupational Therapy Handwriting Assessments

The literature sources obtained on the occupational therapy handwriting assessments illustrated numerous formal and informal evaluations of handwriting exist. Functional component evaluation tools were identified to evaluate global and component legibility, speed, grasp, pencil pressure. Informal assessments of quality, speed, ergonomic and biomechanical evaluations were also identified within the literature. No evaluations (formal or informal) of handwriting content were identified within the occupational therapy literature on handwriting. Informal ratings of handwriting quality typically used scales. Psychometric testing of the formal evaluations of functional handwriting skills was reported within the literature source. The reliability and validity of the evaluations in the literature illustrated conflicting results depending on the population, age, and ability. Out of all of the literature sources that were obtained and reported on the functional component evaluation tools, only one literature source included measures of a child's personal satisfaction of his/her handwriting performance (Roberts et al., 2010). Additionally, this same study was the only study to also establish and measure clinically significant changes of handwriting quality versus using only statistically significant changes (Roberts et al.). The literature sources obtained also reported on the psychometric properties of standardized assessments. The psychometric analysis of the BOTMP, VMI, in-hand manipulation (translation and rotation); SCISIT of FI, SCSIT of Kinesthesia, Steadiness Test and the TVPS were reported to predict handwriting performance or significantly correlate with handwriting skill. Most studies were observed to provide a clausal statement that the findings are generalizable only to the population studied and that the evaluation or assessment tools should be used in conjunction with other formal and informal evaluation tools. The integrated review illustrated that there are numerous handwriting evaluation tools available to occupational therapists. However no evaluation tool was identified to be able to establish definitive, non-conflicting, psychometric properties. As a result, the only assessment tools, which appear to illustrate conclusive results regarding handwriting performance, are the personal satisfaction and outcome ratings of the child and teacher. This is because the handwriting perspectives and experiences of these two individuals are the most important because they are the clients.

The final *occupational interaction* explored was the between the occupational therapist and handwriting treatments.

5.8.11 Sub-Factor: Occupational Therapy Treatment of Handwriting

This section explored the occupational therapy literature sources on handwriting treatments. An overview of the treatment process is presented initially. The occupational therapy treatment approaches and outcomes have been grouped and presented according to the service provision approaches identified within the literature sources obtained. A summary of this sub-factor concluded this chapter.

Ziviani and Watson-Will reported, "there will always be children who struggle with the acquisition of proficient handwriting and who will require therapy" (Ziviani & Watson-Will, 1996, p. 64). "Early intervention of handwriting difficulties is particularly important to avoid the secondary effects of academic failure, poor self-esteem, and decreased compositional fluency" (Feder et al., 2007, pp. 58-59). Therefore, occupational therapists must be familiar with the task requirements (Ziviani & Watson-Will), the child's strengths and weaknesses, and the educational goal to better collaborate with the teachers to development more effective interventions (Jewell, 1999). Occupational therapy handwriting treatment approaches may emphasize facilitating the improvement of performance components, mastery of writing skills, minimizing the effect of deficits, or modifying the tasks (Chu, 1997). The ultimate goal of occupational therapy treatment is to provide improvement in handwriting (Tam et al., 2009). However, "many occupational therapy interventions are directed at modifying the classroom environment or teacher expectations" (Rigby & Schwellnus, 1999, p. 9). The Conceptual Model for Performance in Handwriting (Chu, 1997), described earlier within the chapter, also describes the treatment process. It has been provided in visual form (see Table 5.2). The occupational therapy treatment process of handwriting problems was described in further detail within the next sections.

5.8.11.1 Treatment Planning

The consistency of treatment planning for handwriting by occupational therapists has been researched. Rigby and Schwellnus (1999) identified in their study using case examples, greater than 50% agreement was found between occupational therapists, for recommending intervention. However, Rigby and Schwellnus also identified that occupational therapists agreed more about the interventions they thought would be relevant and less about the interventions they would prioritize. It was identified that occupational therapists make decisions regarding the intervention plan based on the combination of assessment outcomes versus matching an intervention to an assessment finding (Rigby & Schwellnus). The costs implied by specific intervention outcomes are also considered by occupational therapists, whereby less expensive approaches, are trialed first (Freeman et al., 2004; Rigby & Schwellnus).

5.8.11.2 Written Reports

The written report is one stage in the intervention process. Written reports are a valuable tool for parents and teachers to reference handwriting strategies previously discussed with the occupational therapists (Chu, 1997). In the study by Bayona et al. (2006) both teachers and parents preferred to receive the report before the end of intervention. However, Chu indicated that given high caseload demands on occupational therapists, the ability to efficiently complete thorough report write-ups in a timely manner is not always realistic.

5.8.11.3 Setting And Prioritizing Goals

Setting and prioritizing goals prior to treatment, as a collaborative effort between the occupational therapist, teacher, parent, and the child if possible, provides an objective for the intervention (Chu, 1997) and outlines the specific roles which are expected of each individual. Chu reported that while “occupational therapy is process-orientated [and] education is product-orientated” (1997, p. 518), both orientations are required for successful intervention outcomes.

Table 5.2 Occupational Therapy Handwriting Treatment Process (Mosey, 1993; Davidoff, Haynes, Sackett, & Smith, 1995 as cited in Chu, 1997; Chu, 1997)

Treatment Goals	
Set treatment goals in collaboration (teachers, parents, student) Goals: specific, realistic, achievable and measureable	
Treatment Principles	
Sensitive to child's needs Meaningful Consider environment, child's motivation, flow (rate of intervention for child, i.e. slow, fast)	
Ongoing Collaboration	
Intervention collaboration with teacher, parent	
Service Provision Approaches (Mosey, 1993 cited in Chu, 1997, p.519)	**Treatment Approaches** (Mosey, 1993 cited in Chu, 1997, p.519)
Remedial	Sensory integrative therapy Sensorimotor therapy Neurodevelopmental treatment Perceptual-motor programmes Visual perceptual training Fine-motor and visual motor skill training Pre-writing training (Klein, 1982 cited in Chu, 1997)
Functional	Biomechanical and ergonomic interventions (i.e. sitting posture, pencil grip) Acquisitional (instructional) approach Alphabet work Multisensory techniques Kinesthestic writing Mystery writing Rainbow writing Guided writing (Price, 1986, cited in Chu, 1997) Self-evaluation checklist
Compensatory	Use of audio-tape Laptop computer Keyboard skill training Someone to do the writing [scribe] Colour code to indicate orientation

Adaptive	Reduce the amount of copying task Put main points or headings on paper Adaptive devices or tools, such as pencil grip, special lined paper, adjustable furniture
Management	Motivational approach- intrinsic and extrinsic Reinforcement program, such as token economy, star chart, praise/reward Relaxation training Peer group support Coping skill training
Maintenance	High power information technology appliances Voice-activated computer
Evidence-Based Practice (Davidoff et al., 1995, cited in Chu, 1997)	
Make clinical decisions based on best available scientific evidence Seek and select evidence to meet a clinical problem rather than habits or protocols Use epidemiological and biostatistical ways of thinking about evidence Carry out critical appraisal of information Constantly evaluate performance	

5.8.11.4 Service Provision

Service provision describes the conditions in which particular occupational therapy treatment approaches and techniques are decided (Chu, 1997). Depending on the prerequisite skills of the child, the purpose of handwriting intervention may be to provide remediation, compensation, function, adaptation, maintenance or management (Mosey, 1993 as cited in Chu 1997). This is determined by the therapist's assessment of the child's handwriting skills, and the motivation and support of the individuals involved. For example, if a remedial service provision approach is chosen, the occupational therapist may integrate a sensorimotor treatment approach to remediate handwriting problems.

5.8.11.5 Treatment Approaches

Occupational therapists' treatment approaches are typically not prescribed protocols or interventions analogous to a cookie cutter. This is due to the nature of the subjects; everyone is different (as identified within the *contextual factors*), the implementation of client-centered approaches and the impact of the service delivery models on intervention (as identified within the *structural factors*), and the *occupational interaction* between

these factors. Although the "literature on handwriting remediation frequently leaves the impression that a specific technique is appropriate for all children with handwriting difficulties" (Malloy-Miller et al., 2009, p. 259). However, "treatment should be directed at remediating [the] underlying dysfunctions" while considering the temporal and environmental impacts (Chu, 1997). The type of treatment approach used is dictated by the service provision. Choosing an appropriate treatment approach and intervention is important for the child to achieve the educational outcomes. The challenges occupational therapists experience are that there are "…limited amount of published research and evidence-based guidance on effective interventions (Judkins et al. 2009, p. 2), or that the evidence provided in the literature is weak.

5.8.11.5.a Remedial & Functional Approaches To Handwriting Intervention

The findings from the literature sources that identified remedial and or functional approaches (simultaneously or separately) were presented in terms of the type of treatment approach, and included instructional approaches and handwriting intervention methods. Remedial approaches "emphasize facilitating the improvement of performance components, such as perceptual training" (Chu, 1997, p. 518) whereas functional approaches "emphasize facilitating mastery of tasks, such as manual writing skills training" (Chu, 1997, p. 518). Because these two approaches reflect the functional and performance components an occupational therapist typically assess, these two intervention approaches were described together.

5.8.11.5.a.1 Eclectic Approach

A Canadian survey completed by occupational therapists, regarding treatment of children with handwriting problems, identified that all therapists reported to use an eclectic approach in treating handwriting and related fine motor problems…" (Feder, et al., 2000, p. 200). Feder et al. identified that "… an eclectic treatment approach, which is likely guided by the individual needs of the child, was favored irrespective of years of experience of work setting" (2000, p. 202). This is supported in the literature findings. Feder et al. (2007) suggested because a wide variety of components (functional and performance components) are required to support the handwriting skills of typically

developing children in grade one, a combination of treatment approaches may be used for handwriting difficulties. Additionally, Case-Smith (2002) reported that therapists use an eclectic intervention approach through the combination of ideas from published curricula and programs. The *Log Handwriting Program (LHP)* describes an eclectic treatment approach.

Log Handwriting Program (LHP), was developed in 1990 by K. Raynal, an occupational therapist in Australia (Mackay, McCluskey and Mayes, 2010). The program is designed to teach the components of legible handwriting sequentially including: letter formations, letter alignment, size and spacing (Mackay, et al, 2010). The program "uses child-friendly imagery… the writing line is colored brown to represent a wooden log, and letters of the alphabet are introduced as animals living inside the log… memorable characters are used to prompt the development " (Mackay et al., 2010, p. 32) of spatial organization. Mackay et al (2010) identified Australian children in year 1 and year 2 who were taught with the Log Handwriting Program, for 8 weeks, demonstrated statistically significant posttest improvements on all of the quality categories of the Minnesota Handwriting Assessment, including: legibility, form, alignment, size and space.

A separate study investigated the outcomes of occupational therapy treatment for handwriting challenges (Case-Smith, 2002). Case-Smith conducted a study with children with handwriting problems in grades two, three, and four who were provided occupational therapy intervention incorporating a variety of techniques, for approximately 16.4 sessions of direct hands-on services (528 mins). These children significantly improved more than those in the comparison group, particularly, in the areas of in-hand manipulation and visual motor control using an eclectic approach (Case-Smith).

Similarly, Peterson and Nelson, 2003 reported that using an eclectic, handwriting intervention approach (biomechanical, sensorimotor and teaching and learning strategies) for grade one children from a federally funded school-based health center for the economically disadvantaged, resulted in statistically greater handwriting performance (on space, line and size) in the intervention group versus the control group as measured by the

MHA. There were no significant changes observed for the control group from pre to posttest.

Similarly, McGarrigle & Nelson (2006) created and evaluated a School Skills Programme for Australian Indigenous children in grade one. The program included an eclectic, culturally relevant approach to handwriting, including: sensorimotor, biomechanical and teaching-learning principles, Indigenous art, the Aboriginal flag, cultural themes, and colors. The program was implemented once a week for six weeks. The results demonstrated statistically significant improvements between the experimental and comparison group, in tracing, copying, writing own name, and writing the alphabet.

5.8.11.5.a.2 Sensorimotor approach

A sensorimotor approach, targets four components: visual perception, visual-motor integration, proprioception/kinesthesia and in-hand manipulation (Denton et al. 2006). Feder et al. (2000) identified that 90% of Canadian occupational therapists reported using a sensorimotor approach. The authors identified that work setting did not influence therapists' treatment approach, except, in the school setting where sensorimotor treatment was used least frequently compared to other settings (Feder et al.).

A multisensory approach includes the use of sensory experiences (vibration, resisted writing, vertical surfaces), media, and instructional materials (Woodward & Swinth, 2002). "Variations in sensory experiences provide a child with enhanced sensory feedback to improve motor skills for daily occupations such as printing" (Ayres, 1972; Bobath, 1978; Rood, 1962 as cited in Peterson & Nelson, 2003, p. 154).

A multisensory approach is often taken to remediate handwriting problems when deficits in sensorimotor performance components are identified (Wallen & Froude, 2007). This is supported by Amundson (2005) who suggested that a multisensory approach is based on a sensorimotor model of practice for handwriting intervention (as cited in Zwicker & Hadwin, 2009). Woodward and Swinth (2002) identified that a majority of American occupational therapists (92.1%) use a multisensory approach. A multisensory approach

uses many different treatment modalities and intervention techniques. Woodward and Swinth (2002) identified that the top three most frequently used multisensory modalities and activities by occupational therapists for handwriting remediation were: chalk and chalkboard (87.3%), magic markers or felt pens (76.0%), followed by verbal descriptions of the letter shapes while the student writes (71.2%). "The most frequently reported number of multisensory modalities and activities used per student was five or more" (36.9%) (Woodward & Swinth, 2002, p. 308). Furthermore, Woodward and Swinth identified that the choice of modalities were not related to demographic variables. The results regarding which sensory systems occupational therapist believe each modality/ activity addressed, was inconclusive (Woodward & Swinth).

Handwriting Without Tears® (HWT) is a multisensory handwriting program developed by Jan Olsen, an occupational therapist, in the United States. Jan Olsen developed the program as a result of her son's experience with handwriting challenges during elementary school. It is also based on a developmental approach; letter sequence taught based on stroke patters progressing from easy to challenging (Case-Smith, 2002). This program has evolved to include readiness, manuscript and cursive instruction. "Multisensory manipulatives" or tools, such as wood pieces, and chalkboards are used in the treatment of handwriting. Letters may be formed with the wood pieces or written on the chalkboards. Letters are taught using a simple, continuous stroke and vertical letter formations. Handwriting Without Tears "uses only two writing lines- a baseline and a center line- which is visually less confusing that the typical school handwriting paper" (Clark-Wentz, 1997, p. 33).

Carlson (2009) investigated the use of a multisensory approach for kindergarten students. Carlson used the multisensory manipulatives: student workbooks, slates and wood pieces from Handwriting Without Tears® together with a writing process which combines letter formation, phonemic awareness, spelling and writing sentences. Carlson reported children in kindergarten improved in their handwriting skills after eight weeks of intervention compared to a control group, although statistical significance was not reported.

Similarly, Marr & Dimeo (2006) implemented a summer handwriting course, using the multisensory, Handwriting Without Tears® curriculum for two weeks with children grades one to grades six. Half of the children recruited, received special education the previous school year. Of those students, more then half received occupational therapy or physiotherapy or speech services (Marr & Dimeo). The reasons for the children being involved in the special education services were not identified within the research study. The results of the pre and posttests illustrate a significant pre-to-posttest change in the formation of the lowercase alphabet and upper case alphabet, measured by the Evaluation Tool of Children's Handwriting (ETCH) (Marr & Dimeo). Parents also reported a significant difference over time, which was maintained three months later (Marr & Dimeo). Furthermore, Marr and Dimeo described the advantages to providing handwriting instruction during the summer months allows for intense, focused, instruction when the stress of school performance is low, and gaining skills through supplementary handwriting practice is beneficial from a motor learning theory perspective. This study did not use a control group.

Additionally, Denton et al. (2006) investigated the impacts of a sensorimotor approach versus therapeutic practice versus a control group in children 6years to 11years with handwriting difficulty. Wallen and Froude (2007b) critically appraised the study and highlighted concerns regarding the researchers published research findings. The specific findings questioned, were not included in this integrative review. It is concluded that neither intervention group significantly differed from the control group (Denton et al.; Wallen & Froude).

Similarly, in Zwicker and Hadwin's (2009) randomized controlled trial, students in grades one and two with handwriting concerns received either a cognitive treatment approach or a multi-sensory treatment approach, once a week for ten weeks at 30minute sessions (300mins). Zwicker and Hadwin identified no significant differences in handwriting outcomes as measured by the VMI and ETCH-M, across the change scores of the cognitive intervention, multisensory intervention and the control group. This indicated that the groups changed the same amount from pre-to-posttest, regardless of

intervention. There was also no significant difference between the type of intervention and the change scores.

5.8.11.5.a.3 Sensory Integrative Approach

Feder et al. (2000) identified that 50% of occupational therapists reported to use a sensory integrative (50%) approach. Sensory integrative interventions, such as the use of weights, often emphasize "tactile and vestibular input and are believed to help children increase their ability to attend and focus" (Case-Smith, 2002, p. 18). Woodward and Swinth (2002) identified that 23.7% of occupational therapists recommend wrist weights as a modality for handwriting intervention, whereas, 68% of Canadian therapists used weights in their clinical practice as a treatment modality for handwriting interventions (Feder et al., 2000). Case-Smith reported occupational therapists were found to use "sensory integration approaches when children demonstrated specific problems in sensory integration" (2002, p. 18). Mulligan (2001) identified that children with attention deficits may demonstrate sensory modulation deficits (as cited in Schilling et al., 2003). Such deficits are described as the ability to interpret incoming sensory information and to adapt and respond to it. One sensory modulation strategy reported is the use of therapy balls in classrooms for the purposes of improving performance (Schilling et al.).

Schilling et al. (2003) investigated the improvements of in-seat behavior and handwriting legibility of fourth grade students with ADHD. Improvements for all students with ADHD were observed in both in-seat behavior and legible word productivity when using the therapy ball versus the chair. Children preferred the balls to the chairs for comfort, writing, and productivity (Schilling et al.). In addition, all the children within the classroom, regardless if they had a diagnosis or ADHD or not, reported that they believed that the therapy ball was more comfortable, improved their writing and increased their ability to listen and finish class work (Schilling et al.). Teacher report indicated, "for some students work production has dramatically improved" (Schilling et al., 2003, p. 540). Thus, the study findings "support the use of therapy balls for students with ADHD as an alternative classroom seating option…both in-seat behavior and legible word productivity improved when seated on the therapy balls" (Schilling et al., 2003, p. 540).

5.8.11.5.a.4 Perceptual Motor Approach

Feder, et al. (2000) identified that 74% of occupational therapists reported to use a perceptual-motor approach. Furner (1970) reported a perceptual-motor approach to handwriting intervention targets the perceptual skills including: form constancy, figure ground, position in space, spatial relationships, hand-eye coordination and improves skills through practice, and early handwriting training (as cited in Addy, 1996). *The Teodorescu Programme,* is a handwriting program which uses a perceptual motor approach (Addy, 1996).

The Teodorescu Programme, described in the research paper by Addy (1996) was based on the perceptuo-motor exercises created by Professor Ion Teodorescu of Romania. Addy (1995) refined, expanded and ordered the exercises based on child development as well as provided additional information to increase usability and drafted a usable formative handwriting program (as cited in Addy, 1996). "The Teodorescu programme provides a perceptuomotor framework in which to develop handwriting skills" (Addy, 1996, p. 428). The program consists of 410 graphic exercises within five booklets. Addy reports the program included exercises, which focus on: hand-eye coordination, the importance of letter forms and the gestalt of the letters within relation to the context word, figure-ground, position in space, and spatial relationships. Furthermore, the program "serves to develop the intrinsic muscles of the child's hand by varying the patterns required to encourage the continuity of a fluent movement" (Addy, 1996, p. 428). *Write From The Start, The Teodorescu Perceptuo-Motor Program* (Ion Teodorescu & Lois Addy, 1998) is the commercially developed handwriting program and may be purchased online.

Addy (1996), investigated the use of the Teodorescu Programme with children 4.0 to 5.6 years of age. Addy found at the end of two school terms using the Toedorescu Programme approximately three times per week, typically developing school children from the United Kingdom, demonstrated improvements in legibility, accuracy, size, slant, spacing and alignment compared to the control group. Furthermore, children with mild learning difficulties and with perceptual-motor weaknesses also demonstrated improvements however there was no control group to compare results against (Addy).

The qualitative findings of this study revealed, "the program helped the teachers to understand aspects of perceptual development relating to handwriting" (Addy, 1996, p. 430).

Additionally, Erhardt and Meade (2005) described a collaborative dynamic process and a perceptual motor approach to handwriting problems. The authors reported that because handwriting was not directly taught, but that visual perceptual motor activities were provided, changes in handwriting performance were attributed to successful program intervention, which included the development of positive relationships, and emphasis of the foundational performance components (Erhardt & Meade).

5.8.11.5.a.5 Motor Learning/Therapeutic Practice

Feder et al. (2000) identified that 68% of occupational therapists reported to use a motor learning approach. In motor learning, skill development is viewed through a dynamic systems lens (Cahill, 2009). Meaning that at any one point, behavior is a result of the combination of all functionally related components (Asher, 2006). "Under this framework, a student's skill with handwriting is thought to be a result of the interaction of various intrinsic and extrinsic factors" (Cahill, 2009, p.225). According to Motor Learning Theory, initial learning should be reinforced by constant, blocked practice (Poole, 1991 as cited in Asher). The practice approach changes from constant blocked practice when a child has established consistency in performance across tasks, to variable practice, and then to random practice to refine skill development (Asher, 2006). A challenge point framework may be used within a motor learning approach, "once students master basic skills, teachers introduce a challenge point" (Cahill, 2009, p.227), or a "Just Right challenge" (Guadagnoli & Lee, 2004 as cited in Cahill, 2009, p.227). This means that the challenge of the task is taken up to an optimal challenge point for the child thus increasing learning (Asher).

Therapeutic practice is a treatment approach, which uses motor learning strategies to improve handwriting skill (Denton et al. 2006). In therapeutic practice, letters are practiced using handwriting practice books and writing activities from memory (Denton

et al.). However, this approach has not been validated in the literature. As mentioned previously, Denton et al. (2006) did not find a significant difference between therapeutic practice and sensorimotor interventions, and a control group in children 6years to 11years with handwriting difficulty.

5.8.11.5.a.6 Cognitive Approach

A cognitive approach to handwriting intervention involves: self-instruction, verbal mediation, imitation, practice, self-evaluation, feedback, shaping, and stimulus fading (Graham & Weinstruab, 1996; Zimmerman, 2002; Meichenbaum, 1977 as cited in Zwicker & Hadwin, 2009). It is suggested that a metacognitive awareness of letter formations is emphasized while the child talks about letters and how to form them (Zwicker & Hadwin).

As mentioned previously, in Zwicker and Hadwin's (2009) randomized controlled trial, students in grades one and two with handwriting concerns received either a cognitive treatment approach or a multi-sensory treatment approach. Zwicker and Hadwin identified no significant differences in handwriting outcomes as measured by the VMI and ETCH-M, across the change scores of the cognitive intervention, multisensory intervention, and the control group.

Missiuna (2002) described a therapeutic problem solving strategy, Cognitive Orientation to daily Occupational Performance (CO-OP) occupational therapists use for children with DCD. CO-OP is described as a top-down approach, which incorporates cognitive strategies, is verbally based and highly individualized (Banks et al, 2008). It is a reported successful intervention approach to facilitate motor skill acquisition (Banks et al.) such as handwriting challenges observed in children with DCD.

In Banks et al. (2008) descriptive study, cognitive strategies or mechanisms underlying the CO-OP approach were described. Four possible mechanisms were identified: Global Strategies, Dimensions of Time on Task, Domain-Specific Strategies, and Type of Guidance to be used by children with DCD to address handwriting problems. Findings

suggest “discussion, not practice was the predominant tool employed [by children with DCD] to improve [handwriting] performance” (Banks et al., 2008, p. 100). Specifically, the authors concluded that the significant amount of time each of the four boys, ranging in age from 6 years 0months to 9years 7months, spent on Talking About the Task, with the prevalence of the observed Planning and Checking strategies, highlight the underlying principles of the CO-OP approach. Furthermore, it was observed that younger children rely more on verbal-domain-specific strategies (Banks et al., 2008, p. 105) to accurately write letters, which is consistent with the developmental process of typical children learning to form letters. It is identified that further research is required, due to the small sample size of the study and gender bias (Banks et al.). Furthermore, it is not clear if these children’s handwriting actually improved as a result of the intervention due to the lack of reported quantitative handwriting outcomes. In any case, this study illustrates the positive potential the CO-OP approach has on children with DCD, to address their handwriting problems. Banks et al. (2008) surmised, because there was a dominance of Task Specifications/ Modification strategies observed in their descriptive study addressing handwriting goals, that “children’s difficulties with handwriting originated from a lack of understanding of what steps constituted the task, how to proceed with these steps, or both” (p. 108). Furthermore, they suggest that their study sample chose handwriting as a goal for intervention likely because the children “failed to grasp what the task of handwriting required of them and how best to proceed with its execution” (Banks et al., 2008, p. 108).

5.8.11.5.a.7 Biomechanical approach

Feder et al. (2000) identified that 64% of occupational therapists reported to use a biomechanical approach. A biomechanical approach to handwriting emphasizes the development of the biomechanical and ergonomic factors such as the writing surface, paper position, posture, strength, and the coordination of joints are necessary for the engagement in handwriting (Benbow, 1995; Levine, 1993 as cited in Peterson & Nelson, 2003). “Biomechanical interventions for strength and mobility utilize occupational forms incorporating resistance, weight bearing and coordination” (Peterson & Nelson, 2003, p. 154).

Rigby and Schwellnus (1999) reported that using "biomechanical theory would provide the OT with principles to guide the analysis of the physical problems in postural control experienced by children with cerebral palsy, and the selection of interventions grouped as aids and adaptations which enable children to compensate for poor postural control" (p. 19)

Dennis and Swinth (2001) identified that "pencil grasp does not have a significant effect on handwriting legibility" (p.180). Therefore, Dennis and Swinth reported, "for students who do not have handwriting difficulties, the use of an atypical grasp may not be a sufficient reason to provide intervention" (2001, p. 181). However, "the long-term biomechanical effects of [atypical] grasps on the soft tissue structures of the hand are not known" (Dennis & Swinth, 2001, p.181).

Yakimishyn and Magill-Evans (2002) investigated the impact of various writing tools (diameters and lengths) and writing surfaces (horizontal and vertical) on grasp patterns of typically developing two year olds (23 months). Yakimishyn and Magill-Evans identified that children who used crayons on a vertical surface improved their grasp pattern to a mature grasp. Yakimishyn and Magill-Evans reported "the short piece of crayon requires the child to prehend the crayon with the tips of the thumb, index and middle fingers, precluding a fisted, whole hand or five-finger grasp" (Yakimishyn & Magill-Evans, 2002, p.569). However, no significant difference was identified in grasp, using the vertical surface and a marker or a pencil. "Children will not use a tripod grasp on a marker when drawing on a vertical surface without a prompt for finger placement" (Yakimishyn & Magill-Evans, 2002, p. 570). The orientation of the writing utensil, (tip to the child), was found to be more effective in promoting a more mature grasp. "In 2-year-olds, the pencil grasp can be influenced by the presentation of the writing tool to the child" (Yakimshyn & Magill-Evans, 2002, p. 570) specifically, "tip pointed toward the child, facilitated neutral or more extended wrist position and the tool being held with the fingers rather than in the palm, thus facilitating a more mature grasp" (Yakimishyn & Magill-Evans, 2002, p.570). A significant gender effect ($p=0.03$) was observed; girls demonstrated more mature grasps then boys (Yakimishyn & Magill-Evans).

Similarly, Oehler et al. (2000) found that the various sizes and shapes of the pencil did not impact the pre-writing skills of typically developing kindergarten children ages five to six years. The findings do not support the use of large diameter or triangular shaped pencils to assist typically developing children's handwriting performance (Oehler et al.).

Burton & Dancisak's (2000) study findings regarding the effect of implement size on grip levels and motor accuracy of three to five year old children were inconclusive. Windsor (2000), critically appraised this research, and ponders whether "we can equate fine motor skill in preschoolers, as measured by motor accuracy, to handwriting skills in the child who is elementary school age" (p. 19). Furthermore, Burton and Dancisak report that changing the grip will not help those children whose grips are "kinesthetically locked in". Windsor commented, based on this finding, occupational therapists should be informing and educating others on how to promote developmentally appropriate foundations for producing proficient handwriting skills in children.

Daly et al (2003) identified that the writing legibility of kindergarten children, was not impacted by the use of lines on a modified version of the SCRIPT. "Thus no significant difference was found in the writing performance of kindergarten students using unlined or lined assessments" (Daly et al., 2003, p. 461). Therefore Daly et al. recommended, "kindergarten age children be allowed to experiment with various types of writing paper media when initially learning proper letter formation, and to explore options that may enhance the quality of written output" (2003, p. 462).

5.8.11.5.a.8 Kinesthetic Approach

The kinesthetic approach to handwriting intervention is based on the premise that the two aspects of kinesthesia (kinesthetic acuity and kinesthetic perception) may be changed to improve motor performance, thus leading to improved letter formations (Laszlo & Bairstow, 1983, 1985b as cited in Sudsawad et al., 2002). Kinesthetic acuity is the ability to distinguish between the various positions or movements; particularly of the fingers, and arm in handwriting (Cornhill & Case-Smith, 1996). While kinesthetic perception is defined as the ability to "perceive and recall movement patterns of an upper limb"

(Sudsawad et al., 2002, p.27). Providing intervention, which targets these two factors, may influence the development of the skilled movements required for handwriting (Laszlo & Bairstow as cited in Sudsawad et al.). Two handwriting programs were identified within the literature to use a kinesthetic approach: *Loops and Other Groups: A Kinesthetic Writing System®* (aka Loops and Other Groups) developed and released by Mary Benbow in 1990 (as cited in Roberts et al., 2010); and *Speed Up! A Kinaesthetic Programme to Develop Fluent Handwriting* was developed by Lois Addy, (as cited in Addy, 2003).

As previously mentioned, Sudsawad et al. (2002), investigated the impact of a kinesthetic treatment approach on grade one students with kinesthetic deficits and handwriting problems compared to handwriting practice, and a control group. However, the effectiveness of a kinesthetic approach to handwriting has not yet been validated (Wallen et al., 2007).

Loops and Other Groups: A Kinesthetic Writing System® (aka Loops and Other Groups) is a cursive writing program developed and released by Mary Benbow in 1990. Letters are grouped and taught according to shared movement patterns. Roberts et al. (2010) reported that this cursive writing program "combines sensorimotor techniques, along with letter formation practice, and includes modeling and verbal analysis of letters, motor learning through tracing, revisualization, verbal self-guidance, handwriting from memory, and self-assessment of letters most accurately produced" (p. 746).

Roberts et al. (2010) evaluated the effectiveness of using the Loops and Other Groups program with grade four to six students with handwriting problems. The results indicated significant increases in ratings of global legibility were found using the Test of Written Language (TOWL) (Roberts et al.). The authors found statistically significant increases in all components of the Handwriting Evaluation Scale (HES) for the unconnected cursive alphabet, and in all components but in size for the connected cursive alphabet (Roberts et al.). Roberts et al. identified an increase of cursive writing speed from the beginning of the study to four months post intervention. Child, parent and teacher reports of the child's

personal satisfaction toward handwriting also showed improvements (Roberts et al.). "Global legibility and components of legibility improved, as well as speed of handwriting and personal satisfaction with handwriting" (Roberts et al., 2010, p.753). Concluding that *Loops and Other Groups: A Kinesthetic Writing System®* "may be effective in improving the skills of students with handwriting challenges" (Roberts et al., 2010, p.745). A control group was not included in this study.

Alternatively, Shimel et al. (2009) investigated the impacts of different treatment approaches using three cursive handwriting programs: Handwriting Without Tears (multisensory), Loops and Other Groups (Kinesthetic), and Zaner-Bloser (functional) with typically developing grade three students. Findings revealed no significant differences in legibility outcomes as measured by the ETCH between the three different cursive writing programs (Shimel et al.). This indicated that the type of intervention did not make a difference (Shimel et al.). The children improved regardless of the intervention received (Shimel et al.).

Speed Up! A Kinaesthetic Programme to Develop Fluent Handwriting, was developed by Lois Addy, an occupational therapists in the United Kingdom. Addy reported the purpose of the cursive handwriting program is to teach letters using a kinesthetic approach, thereby increasing speed and fluency (2003). The program is specifically designed for children aged 8-13. It targets children's cursive handwriting that is slow, illegible, or lacking fluency. There is a decrease dependency within older children for input from the sensory modalities, because as children get older they tend to rely less on visual input while writing and more focus is given to the cognitive aspects of the activity (Addy, 2003). Therefore the Speed Up! program uses activities to "arouse the kinaesthetic sense" (Addy, 2003, p. 13) in the body and increase awareness of joints and pressure. It also helps children visualize mental pictures and patters while decreasing anxiety to liberate the arm and hand through fun activities (Addy, 2003). No research outcomes have been reported on the effectiveness of this program.

5.8.11.5.b Compensatory Approach To Handwriting

Occupational therapists may also provide children with compensatory approaches, which include a range of tools, to enable engagement in written productivity (Freeman et al., 2004) depending on the child's history of skill development, the quality and quantity of the child's written outcomes, and the current levels of frustration experienced. "Compensatory approaches emphasize minimizing the effect of deficits in performance components in areas of functional performance" (Chu, 1997, p. 518).

Numerous low and high tech compensatory strategies may be considered, such as providing raised lined paper or reducing the quantity or quality of written outcomes, or allowing a child to use a scribe, or a tape recorder to record the child's ideas (Chu, 1997). Freeman et al. (2004) reports, "little research evidence is available concerning the factors guiding therapists recommendations of technology options for children experiencing handwriting difficulties, including whether particular person, environment or occupation factors might be more influential for some technologies than others" (p.151). Swinth (2001) suggests that "informed decision making, supported by evidence, by therapists when recommending assistive technology for students experiencing handwriting difficulties is crucial for promoting successful procurement and long-term use" (as cited in Freeman et al., 2004, p. 151).

Occupational therapists across Canada are most-frequently recommending keyboarding-based strategies, including: desktop computers, laptop computers, or alternate output devices for children with handwriting problems (Freeman et al., 2004). Furthermore, the clinical reasoning, why occupational therapists reported to recommend one keyboarding strategy over another, was impacted by the cost or funding availability, followed by equipment portability (Freeman et al.). The second most popular strategy recommended by Canadian occupational therapists was a mixture of both keyboard and dictation based strategies (Freeman et al.). The third most recommended strategy was dictation-based strategies (Freeman et al.). The authors identified that the availability of support in the

school was the most influential factor in occupational therapists' recommendation of the mixture of keyboard and dictation, and diction-based strategies (Freeman et al.).

The disadvantages for using or recommending technology have been reported in the occupational therapy literature, including: lack of support, costs/funding availability, and lack of keyboarding competency (Freeman et al., 2004). Additionally, similar to handwriting, children need to be taught how to keyboard. Children need "time for keyboarding practice, a classroom environment that is technology friendly, and instruction in how to use the technology with keyboarding training and level of keyboarding competence is important" (Handley-More et al., 2003, p. 148).

Rogers and Case-Smith (2002) identified, upon typically developing grade six students receiving sufficient keyboarding instruction (12 weeks), keyboarding speed on average was 14.9 words per minute. This was identified as 5 words per minute faster than their handwriting (Rogers & Case-Smith). Overall, "handwriting speed and legibility demonstrated low to moderate correlations with keyboarding speed" (Rogers & Case-Smith, 2002, p.37). Rogers and Case-Smith found that although handwriting and keyboarding skills share some common elements (motor performance), the two occupations also have many elements that differ. "The low level of correlation suggests that some children with relatively poor handwriting legibility can be effective in keyboarding" (Rogers & Case-Smith, 2002, p. 37). Conversely, Handley-More et al. (2003) identified the rate of handwriting exceeded the rate of written output using word processing and word processing and word prediction. However, when children with handwriting problems and learning disabilities, are given the opportunity to use technology options over printing, the benefits include improvements in children's spelling and handwriting legibility (Handley-More et al.). Freeman et al., (2004) concluded, "it does not seem clear that consensus has been reached about an underlying evidence base upon which technology recommendations are being made for students experiencing handwriting problems" (p.158).

5.8.11.5.c Adaptive Approach

Chu (1997) described an adaptive approach as one, which "emphasizes changing the task, or aspects of the environment, to minimize the effect of deficit in performance subcomponents and/or related behaviors on areas of occupational performance" (p.518).

Rigby and Schwellnus (1999) identified occupational therapists "preferred using aids and adaptations to allow children [with cerebral palsy] to compensate for physical impairments by accessing environmental supports" (p.22). Furthermore, occupational therapists reported they would recommend supportive seating, angled writing surfaces, and pencil grips "to promote better posture and to improve pencil grasp" (Rigby & Schwellnus, 1999, p.22) for children who have cerebral palsy (Rigby & Schwellnus).

5.8.12 Summary: Occupational Therapy Treatment of Handwriting

The occupational therapy literature sources obtained on the handwriting treatments mirrors the complexity of the assessment tools found. The literature illustrated that occupational therapists provide handwriting interventions to children using numerous service provision approaches. The four identified within the literature sources obtained included: Remedial, Functional, Compensatory and Adaptive. A variety of treatment approaches have also been discussed within the literature. The treatment approaches were found to target function and underlying performance components. However, not one treatment approach was established to be better than the other. Similarly, numerous occupational therapy handwriting instructional programs, which are used in occupational therapy interventions for handwriting problems, have been described within the literatures sources. Although positive outcomes were reported with use, not one instructional program was established as the best in comparison to the others.

5.9 Summary Of The Findings & Categorization of the Literature

This chapter presented the findings and categorizations from the occupational therapy literature on handwriting. According to the *Revised Framework of Occupational Justice*

the findings of the seventy-five literature sources were categorized and presented according to the factors within the framework. The literature sources identified *structural factors*, specifically *occupational forms*, *contextual factors, occupation factors* and the most significant, *occupational interactions*. A summary of the findings of the integrative review process, the identified conditions leading to outcomes of occupational injustice, implications for occupational therapy practice, limitations, and future research were explored within the next chapter.

CHAPTER 6 DISCUSSION & CONCLUSIONS

The purpose of this study was to conduct an integrative review of the occupational therapy literature on handwriting for purposes of better understanding the occupation, and to identify the conditions contributing to an occupational injustice in handwriting. At the outset of this integrative review, the three objective questions were presented. The objectives were to identify the factors found, or missing from the literature contributing to conditions of an occupational injustice, and to determine the utility of the Framework of Occupational Justice. An integrated review methodology was used to collect, analyze, and present the literature sources. The *Revised Framework of Occupational Justice* was used to categorize the identified literature sources into *structural factors*, *contextual factors*, *occupational factors*, and *occupational interactions*. Using the integrated review together with the *Revised Framework of Occupational Justice*, the occupational therapy literature on handwriting was collected and integrated. The factors identified in the literature were analyzed for conditions leading to occupational injustices. This chapter summarizes the findings, reveals the factors contributing to potential conditions leading to an occupational injustice, discusses the limitations, describes the practice implications, and identifies areas for future research. The first section will provide a summary of the findings of the integrated review.

6.1 Summary Of The Findings From The Integrated Review

Two summaries of the integrated review are presented based on (1) the characteristics and (2) the content of the literature sources collected. Following this, a summary of the factors contributing to conditions of occupational injustice was described.

6.1.1 An Integrated Summary Of The Characteristics Of The Literature

A discussion of the characteristics of the literature collected for the purposes of the integrated review has been presented within this section. Seventy-five, highly utilizable and highly relevant occupational therapy literature sources on handwriting were included

in the integrated review, from a possible two hundred and twenty six sources published in the past fifteen years. The sources collected comprised a diverse sampling frame inclusive of empirical and theoretical occupational therapy literature and displayed strong design/content rigour. Predominantly, 92% of the included occupational therapy literature sources on handwriting were categorized as quantitative and alternative publications. While only 8% of the literature sources were identified to employ psychometric analyses and mixed methodologies; no qualitative designs were identified within the sample. This illustrated that our understanding of handwriting is limited to a positivist-oriented perspective because of the disproportion of the quantitative methodologies published in the literature.

Fourteen literature sources were categorized as *structural factors: occupational forms*. Fifteen were categorized as *contextual factors*. All of the literature sources collected identified the *occupation factors* and the *occupational interactions*. This is likely because occupation is the core domain of occupational therapy and because the main focus of the integrative review was on the occupation of handwriting. This focus was reinforced by the search terms used; handwriting, and the inclusion criteria; the first inclusion criterion ensured only handwriting literature sources were collected.

Known literature sources which would have been integral to the study findings, were excluded based on methodological limitations in the search strategy. Specifically, literature sources on occupational therapy and teaching: professional position statements and guidelines, undergraduate learning outcomes, and educational curriculum outcomes on handwriting, were not included in the integrated review. The statistical documentation that illustrates the disproportion of school-based occupational therapists to children with handwriting problems was also not identified. In addition, known literature sources on handwriting authored by occupational therapists were excluded because of the pre-determined language restrictions included in the inclusion criteria. However, in the absence of particular *structural factors* this provides further insight into the conditions that lead to outcomes of occupational injustice. The factors found to contribute to the

conditions of occupational injustice will be discussed later within this chapter. The next section will discuss the content of the literature findings.

6.1.2 An Integrated Summary Of The Content Of The Literature

The content of the occupational therapy literature sources on handwriting was integrated and summarized. A synopsis of the findings is provided below.

The *occupational interaction* between the child and handwriting is meaningful. Handwriting was established as a meaningful and significant school-based occupation, which enables a child to demonstrate their academic knowledge. Handwriting problems may be present with or without a medical diagnosis. Poor handwriting was found to impact a child's frustration, self-esteem, and grades (Clark-Wentz, 1997; Cornhill & Case-Smith, 1996; Cunningham, 1996; Feder et al., 2000; Hammerschmidt & Sudsawad, 2004; Malloy-Miller et al., 1995).

The typical development of handwriting skills occurs pre and post kindergarten (Daly et al, 2003). Conflicting information regarding the consistency of longitudinal handwriting skills, the impacts of gender, age, and grip patterns on speed and legibility were identified within the literature. Boys were identified with handwriting concerns more often than girls (Case-Smith, 2002; Zwicker & Hadwin, 2009), even though some literature sources identified there were no gender differences in handwriting performance (Weintruab & Graham, 2000; Peterson & Nelson, 2003; Zwicker & Hadwin). Typically developing children demonstrate an inverse relationship between legibility and speed: as speed increases, legibility decreases (Ziviani & Watson-Will, 1998). The impacts of ethnicity and socioeconomic status were also identified to negatively impact educational outcomes, although limited literature sources were available to support this (Peterson & Nelson; McGarrigle & Nelson, 2006). More literature sources and information regarding the impacts of the biological characteristics of the individual were identified, than regarding the impacts of the social, or cultural characteristics on handwriting.

Explicit links of the impact of the *contextual factors*, biological characteristics, to the engagement in school-based activities and educational outcomes were identified. In general, medical diagnoses and the resulting characteristics or symptoms were identified to have a significant impact on the child's school-based performance, particularly the academic outcomes/achievements, compared to typically developing children the same age. Children with developmental disabilities demonstrate similar functional handwriting concerns as typically developing children (Missiuna, 1999). However, the severity and probability of the handwriting concerns are greater in children with developmental disabilities. Six medical diagnoses were commonly identified within the occupational therapy literature on handwriting including: mild motor difficulties/ developmental coordination disorder, perceptual and motor weaknesses, cerebral palsy/ hemiplegia, preterm births, attention deficit hyperactivity disorder and learning disabilities. Mild motor impairments/ developmental coordination disorder were the most commonly reported and the most comprehensive medical diagnoses described within the occupational therapy literature on handwriting in the past fifteen years. Common characteristics between all of the medical diagnoses suggests that sensorimotor: specifically motor skills; and cognitive skills are primarily impacted in school-aged children. No literature sources identified a primary issue with psychosocial skills and handwriting, although psychosocial impacts secondary to the sensorimotor or cognitive skills were identified. The prevalence of the identified medical diagnoses was high; up to 6% of all school-aged children were reported to have at least one of the diagnoses (Dewwy & Wilson, as cited in Banks et al., 2008; Jaska, 1998; Rosenblum, 2000, as cited in Shilling et al., 2003).

The *occupational interactions* between the teacher and handwriting are important. This is because the teacher is the primary individual responsible for introducing and instructing the skills of handwriting to children. Although there is some consensus in the belief that handwriting should be taught, there was an identified inconsistency of handwriting instruction methods used within the school system (Asher, 2006). This may be because the individuals responsible for the instruction of handwriting skills were themselves not instructed on handwriting (Kiss, 2007; Marr, 2001). It may also be a result of the

inconsistent curriculum outcomes in teacher preparation programs. The inconsistency in handwriting instruction also includes varying opinions on whether handwriting should be evaluated by teachers (Asher; Hamerschmidt & Sudsawad, 2004). Those who do evaluate handwriting were identified to use non-standardized, subjective measures (Hamerschmidt & Sudsawad). The validity of teachers' evaluation abilities was also identified as inconsistent in the literature sources obtained.

An *occupational interaction* was identified between handwriting and the two *occupational forms*: teachers and occupational therapists. Both of these groups of professionals are involved with the occupation of handwriting however the professional roles differ. Because of varying theoretical and professional definitions, it is essential to establish clear definitions on: roles, service delivery, handwriting performance issues, performance outcomes, and evaluation methods between the two occupational forms (Daniel & Froude, 1998; Hammerschmidt & Sudsawad, 2004; Miller et al., 2001). Clear definitions need to be established between the occupational therapist and the teacher prior to involvement, otherwise, the child's performance in handwriting is impacted (Daniel & Froude). In the process of establishing these definitions, collaboration between the two professionals begins. Collaboration between the teacher and occupational therapist was identified to improve children's handwriting outcomes (Bayona et al, 2006; Case-Smith, 2002; Chu, 1997).

The *occupational interaction* between occupational therapy and handwriting is fundamental. This is because occupational therapy values meaningful occupational engagement and handwriting is an identified meaningful occupation (Cunningham, 1992). Handwriting problems are a major referral source for occupational therapists (Cunningham, 1992). This is because occupational therapists' possess unique skills to support and advocate for individuals and groups who experience challenges with occupational engagement (Chu, 1997; Daniel & Froude, 1998; Judkins et al., 2009; McGarrigle & Nelson, 2006; Wallen et al, 1996). Specific knowledge on the components of handwriting and the educational outcomes were also identified as an important factor (Chu; Jewell, 1999; Wallen et al.).

The environment, or factors external to the occupational therapist may impact effective or efficient practice. Three occupational therapy service delivery models: Direct, Consultation and Combination may be used to guide occupational therapy practice. Each model presented unique strengths and weaknesses. The provision of consultation service delivery models is a predominant trend in health care practice (Feder et al., 2000) although a majority of teachers report they preferred the pullout model (Hammerschmidt & Sudsawad, 2004; Sandler, 1997 as cited in Bayona et al., 2006). Regardless of the service delivery model employed, improvements in handwriting outcomes were reported (Case-Smith, 2002; Bayona et al., 2006; Kiss, 2007).

Clinical reasoning and evidence-based practice are two concepts that influence the quality of occupational therapy practice. These skills possess an inherent challenge to the occupational therapist because they require time and support to develop. However, three decision-making tools (frameworks or protocols) were identified and are available to support the clinical reasoning skills of occupational therapists. These tools are practical step-wise decision-making resources for the assessment of handwriting problems and for assisting occupational therapists in the decisions regarding suitable interventions for children with handwriting difficulties. It was established that in the past fifteen years, one educational psychology and six occupational therapy literature reviews on handwriting have been conducted and published. These identified reviews and the current integrated review establishes an opportunity for occupational therapists to implement evidence-based practice. This is because the documented research evidence is concentrated and consolidated into eight key literature sources on handwriting.

The complexities of the occupational performance of handwriting were illustrated within the inconsistency of the education instructional methods and health care interventions used. Conflicting opinions were identified within the occupational therapy literature regarding the variables contributing to and required for successful handwriting, specifically between the functional components and the performance components. Variations were also identified within the sub-factors, such as different handwriting styles, grasps, and components of visual perception, etcetera. This further illustrated the

complexity of the occupation. The occupational therapy literature sources were identified to commonly describe handwriting analysis, grasp, and sensorimotor skills.

Numerous formal and informal occupational therapy handwriting evaluations exist. Functional component evaluation tools may be used to evaluate global and component legibility, speed, and ergonomic and biomechanical features such as: grasp and pencil pressure. No evaluations of handwriting content were identified within the literature sources. A tendency for occupational therapists to mainly assess the physical components versus the cognitive or psychosocial components of handwriting is reflected in the amount of assessment tools available per component. Standardized assessments of the performance components, particularly the BOTMP, VMI, in-hand manipulation (translation and rotation); SCISIT of FI, SCSIT of Kinesthesia, Steadiness Test and the TVPS were reported to correlate with handwriting performance. The reliability and validity of the occupational therapy formal evaluations of handwriting illustrated conflicting results dependent on the population, age, and ability.

The majority of the literature sources placed hierarchical status on the statistical significance or the quantitative outcomes of the evaluation tools and assessment findings. Very limited emphasis was reported on the qualitative observations included in assessments (Windsor 2000), the importance of clinically significant changes of handwriting quality, and on the child's personal satisfaction of his/her handwriting performance. Together these findings illustrate the trend in occupational therapy to rely on a positivist perspective including statically significant or quantitative outcomes versus qualitative observations, clinically meaningful handwriting outcomes, and children's and teacher's personal perspectives on skills and experiences. The literature sources reported that evaluation tools and assessments should be used in conjunction with other formal and informal investigations of handwriting skills. This is because no evaluation tools or assessments were able to establish definitive, non-conflicting psychometric properties. This supports that the only meaningful tool that appears to be appropriate for use as an outcome measure alone, is the handwriting satisfaction ratings of the child and the individuals evaluating handwriting; the teacher.

The occupational therapy handwriting treatments mirror the intricacies of the assessment tools used. The occupational therapists' role in intervention is to create an environment for meaningful occupations. Occupational therapists provide handwriting interventions to children using service provision approaches. The four most commonly reported service provision approaches identified within the occupational therapy literature sources on handwriting over the past fifteen years were: Remedial, Functional, Compensatory and Adaptive. Based on the findings, meaningful and culturally relevant treatment methods may be the most appropriate approach to target the functional and underlying performance components of handwriting. No one-treatment approach was established to be better than the other. Similarly, no one occupational therapy handwriting instructional program was established to be better than the other.

Lastly, the history of cursive handwriting illustrated that from the time of introduction to over four hundred years later, it is slowly becoming extinct (Dougherty, 1917; Wallace & Schomer, 1994). The history of manuscript handwriting revealed that manuscript writing was introduced to replace cursive writing (Wallace & Schomer). The literature sources indicate that the introduction of written output technology, specifically the typewriter, was introduced only shortly (5 years: 1921 to 1926) after manuscript writing was introduced in the American school-systems (Rogers & Case-Smith, 2002). This illustrates that manuscript writing and alternative forms of written communication using technology have thus far, evolved in parallel fashion. The ebbs-and-flows of both forms of written expression are evident in their histories. During the early nineteen-twenties, typewriters were too expensive (Rogers & Case-Smith). During this period, manuscript and cursive writing were the primary written outcome methods used. The obtained literature sources also illustrated that while one form of written expression (keyboarding) may be beneficial for one child or for one diagnostic characteristic, the opposite form (manuscript) may be more beneficial for another child. The trends identified within the literature sources indicated that both forms of written output (manuscript and keyboarding) provide a valuable educational resource. Given the nature of their associated history, one may not be in threat of dominating the other. Manuscript writing and technology have evolved in a symbiosis since conception, which is reflective of the individual's needs, and the

economic supply and demand. If the longevity of manuscript writing and keyboarding is parallel to the longevity of cursive writing, these two forms will continue to be required as the stable form of written output expression. This is observed in the introduction of electronic tablets, which allow for the manuscript form of writing to interface with the benefits of technology. The current state of written output expression demands that until the manuscript handwriting has become extinct to keyboarding or some other form of technology, consistent and effective instructional and remedial methods for manuscript handwriting are required. The factors identified within the integrated review contributing to the conditions of an occupational injustice of handwriting in the school system today are presented in the next section.

6.2 Conditions Leading To Occupational Injustice

This section of the integrated review presented the identified factors contributing to possible conditions of occupational injustice encountered within the seventy-five occupational therapy literature sources on handwriting. The complexities of the *occupational interactions* between the literature findings on the *structural, contextual* and *occupation factors* contributed to a more comprehensive understanding of the occupation of handwriting. In addition, as a result of the *occupational interactions* explored, it was concluded that a child, teacher, and an occupational therapists might experience an occupational injustice in handwriting. The conditions of occupational injustice are presented in the same order as the literature search results. Following this, a discussion on the *Revised Framework of Occupational Justice* is presented.

6.2.1 Occupational Injustice: Research Paradigms

The first identified factor leading to possible conditions of occupational injustice includes the research paradigms used by occupational therapists in pediatrics to investigate an understanding of handwriting.

The literature sources illustrated that occupational therapists predominantly obtained the knowledge on handwriting from one perspective, through a positivist research paradigm. This philosophical foundation establishes an a priori acceptance of truth exists. Meaning a singular, knowable truth exists. The occupational therapy practice context in handwriting favors the use of a positivist philosophical foundation. This is because occupational therapists require the most appropriate, informative, and truthful assessment and treatment methodologies, to provide the best intervention practices to ensure the optimal outcomes for children with handwriting problems are achieved.

In predominantly using a positivist research paradigm, occupational therapists are limiting their understanding of the child's or teacher's perspectives or experiences in handwriting. The child's and teacher's perspective is particularly important, because occupational therapists practice with a client-centered enablement approach and because in school-based occupational therapy practice, the child and the teacher are the client. In addition, this perspective is important because an occupational justice perspective, which is derived from a critical theoretical paradigm was used to guide the analysis of the literature. The critical theoretical paradigm of the *Revised Framework of Occupational Justice* honours the identification of the interaction between the individual and the different components of occupation, contexts and social structures. By definition, this framework and paradigm would assume that not one truth exists in the practice context of handwriting, that the client experiences their own subjective reality. Considering this critical approach may help to uncover a better understanding of handwriting.

Randomized controlled trials (RCTs) are identified as the highest standard of quantitative research. A RCT establishes that the results gathered are likely true beyond doubt because of the stringent methodological rigour. Because of this, it may be assumed that this research paradigm was used most often because it would identify the best occupational therapy handwriting assessments and intervention methods. However, only two RCTs were identified within the seventy-five research literature sources collected. Reasons limiting or impacting the decisions for choosing to implement a RCT include: the lack of participants required to conduct a true RCT, the expertise required to propose and conduct

this research design is highly refined, and the ability to control for external variables impacting the outcomes of the results is challenging. This illustrates that it is justifiable why RCTs are not completed more often. However, this also would suggest that the research conducted and the literature obtained for purposes of establishing the best handwriting assessments and interventions, inherently have limitations in the findings because it is not a RCT. Given the information presented on both philosophical foundations and world views, the question remains to be asked, wouldn't other research paradigms provide an additional, valuable, subjective perspective on handwriting with equally high quality in the findings?

Not one study was identified as a qualitative design. One strength of a qualitative research design is that it assumes no a priori of truth; multiple truths can exist. Qualitative research on handwriting may provide a deeper understanding of the occupation and the variation of factors impacting handwriting. This is because, as the seventy-five literature sources illustrated through the conflicting findings, multiple truths may exist. The question remains to be asked, if qualitative research is not being conducted on the handwriting practices in occupational therapy, why not?

As identified within the literature sources, handwriting was established to be a complex occupation. Numerous factors, such as age, gender, ethnicity and socioeconomic status, were identified to impact the outcomes of handwriting performance. Given that there are inherent limitations identified with using any one type of research methodology and that handwriting is a complex occupation, perhaps the answer is to use diverse research paradigms. Only 8% of the literature sources were identified as psychometric analysis and mixed methodology. One out of the seventy-five literature sources was identified as a mixed methodology research design.

The condition of occupational injustice described, is that various research methodologies on handwriting may produce a more comprehensive understanding of the occupation. Because the handwriting literature was proportionally skewed towards the positivist research paradigm, foundational knowledge contributing to a better understanding of

subjective experiences of handwriting is being missed, leading to an infringement on the charter of occupational rights. Because this does not promote a client-centered enablement approach to handwriting, this leads to conditions creating an occupational injustice.

Similarly, there were literature sources that were excluded because they were not published pieces within journal articles. It is assumed that because there are numerous educational institutions and tertiary teaching facilities in Canada, a vast number valuable research studies are likely being conducted within universities by master and/or doctoral students and in the clinical setting by clinicians. These research outcomes would likely contribute to the better understanding of the occupation of handwriting. The condition contributing to the occupational injustice is that without publication, the public may not readily access or identify many of these literature sources and findings, therefore valuable knowledge on handwriting may not be used to it's full potential. Thus, this may be impacting a child's occupational right to participate in handwriting or a teacher's or an occupational therapist's right to experience meaning in handwriting instruction and intervention if information is not readily available to support these individuals.

In summary, the type of research paradigms used to conduct occupational therapy research and the lack of publicizing handwriting research findings may contribute to the conditions of injustice because only a portion of the information may be available to influence handwriting participation or practice.

6.2.2 Occupational Injustice: Structural Factors

The literature sources identified two *structural factors*, specifically *occupational forms*: occupational therapy and technology. The occupational injustice identified here is imbedded in the reason why other *structural factors*, particularly *occupational determinants* were not identified in the initial search strategy. As illustrated in the introduction of this integrative review, there are literature sources that identify the teacher's perspective regarding their lack of undergraduate educational experiences, to

learn appropriate methods of handwriting instruction. In addition, literature sources on the disproportionate ratio of limited occupational therapists to children are also known to exist, but were not identified due to the predetermined search strategy. In addition, the departments of education handwriting curriculum outcomes and the occupational therapy position papers and guidelines were not identified. Because these were known factors and they were not identified using the initial search strategy, a second search was conducted using a revised search strategy. However, due to the predetermined inclusion/exclusion criterion, the results from the second search strategy were excluded and not explored further. The occupational injustice resulting from the exclusion of these two factors within the integrated review will now be explored.

The first condition uncovered that might lead to an occupational injustice was the lack of an occupational therapist author on the English language arts curriculum documents (see Appendices R to AE). The second condition leading to the occupational injustice was that no occupational therapy position statements or pediatric guidelines specific to handwriting was identified. This is also likely a result of occupational therapists adopting a positivist world view that has prevented them from taking a critical perspective to identify and address issues of occupational injustices. In adopting a critical theoretical perspective using the occupational justice framework, this enables a process of identifying the factors contributing to conditions of occupational injustices. As a result of this critical perspective, the gaps in the literature or in the individual's role would be clearly revealed, thus promoting evidence to advocate for change.

Handwriting is a major role for school-based occupational therapists. Occupational therapists provide handwriting interventions, which include an educationally relevant focus, and in some circles, occupational therapists are referred to as the "handwriting gurus". Given the amount of occupational therapy publications on handwriting, this illustrates that occupational therapists have valuable information to provide on handwriting problems. As such, it was revealing to identify that occupational therapists are not involved in the creation of the handwriting curriculum outcomes. Because handwriting is identified as a major role for occupational therapists, it was also revealing

to identify that no pediatric position paper or guideline on handwriting was identified within the occupational therapy professional organizations.

The literature sources revealed that the role of the occupational therapist is not only to support meaningful engagement, it is also to advocate for it as well. The three foundational pillars of occupational therapy knowledge describe that meaningful, client-centered engagement in occupations (Townsend 2003; Townsend & Whiteford, 2005; Townsend & Wilcock, 2004) is an occupational right of an individual. Based on this, and the knowledge that an occupational therapist's role also includes advocacy, than the solution to this occupational injustice lay within occupational therapists. Because it was identified that occupational therapists were not authors nor consultants on the handwriting curriculum outcomes and because occupational therapists are well suited to assess and support the skills required for handwriting, than it is suggested that occupational therapists need to advocate to become authors or consultants on the curriculum outcomes because of the value they can provide. In addition, because a major role for occupational therapists across Canada is to provide handwriting interventions to children in schools, than it is suggested that occupational therapists need to advocate for the development of guidelines, position papers and/or supportive documents on handwriting tailored for both the public needs and professional needs. In summary, occupational therapists need to move beyond clinical practice, to start taking a critical perspective, and advocate for a role in policy development and educational outcomes.

In addition, the time required to navigate the different Departments of Education websites to find the English Language curriculum outcomes, to sift through the literature, to identify the handwriting outcomes was substantial. This is similarly true for the time required to identify the position statements, professional guidelines on occupational therapy organization websites across Canada. Lederer (2004) reported that evidence-based practice is limited due to the time and effort required to identify the appropriate literature sources. This may be the case for these two *structural factors*. The navigational skills required to identify the handwriting outcomes relevant to occupational therapy practice may contribute to conditions of occupational injustice for the occupational

therapists. According to an occupational justice perspective, all individuals have the right to participate in meaningful occupations, to have access to equal opportunities and resources. However, the resources are not transparent or easily accessible by all. Attempting to identify the curricula outcomes on handwriting given this challenge does not create meaningful engagement for the occupational therapist or teacher in search of the outcomes.

6.2.3 Occupational Injustice: Contextual Factors

The literature on *contextual factors* illustrated that six medical diagnoses were identified within the handwriting literature sources. Mild motor problems/developmental disabilities were identified to be the most common *contextual factor* identified. The disproportion in the number of literature sources found on each diagnosis might contribute to the conditions of an occupational injustice. More specifically, the occupational injustice is imbedded in the visibility/invisibility of some disabilities. The emphasis on particular medical conditions in the research literature illustrates the fundable topics. The invisibility of diagnoses, such as autism and non-verbal learning disabilities, which may also contribute to handwriting challenges, are not explicitly identified nor addressed within the obtained occupational therapy literature collected on handwriting. This leads to conditions of an occupational injustice because the research, which would provide better evidence for occupational therapists to tailor their assessment or intervention methods to these specific diagnoses, is not available. Therefore, occupational therapist may not be creating an environment for the child to achieve the best possible outcomes. This is an injustice of the child's occupational right to benefit from fair privileges to participate in meaningful, enriching and diverse occupations, which promote health and social inclusion.

The social and cultural characteristics of the child, specifically ethnicity and the socioeconomic status of the child's family were also found to negatively impact the educational outcomes of children in the school-system (Peterson & Nelson; McGarrigle & Nelson, 2006). However, limited literature sources on these *contextual factors* and the

disproportion of literature sources favoring biological *contextual factors* were found. Without more information on these characteristics and the impacts on handwriting, preventative methods or solutions may not be incorporated into the child's educational experience. This might contribute to conditions of occupational injustice.

6.2.4 Occupational Injustice: Occupational Interactions

The *occupational interactions* of the child, teacher, and occupational therapists with handwriting were described. Within each of these interactions, conditions which may lead to occupational injustices are identified below.

A major theme identified within the literature sources was that there was conflicting information regarding the *occupational interactions* of the *structural* and *contextual factors* and handwriting. Information on the typical development of the occupation of handwriting and the sub-factors of handwriting, including: grasp, legibility and speed are not well known. In addition, the inconsistency of common definitions or an understanding of the skills required for handwriting, particularly between teachers and occupational therapists were also identified. The conflicting or inconsistent information regarding the occupation and therefore the lack of clarity between the two professions may lead to conditions of occupational injustice.

The inconsistency of handwriting instruction and evaluation by teachers within the school system might also lead to conditions contributing to an occupational injustice. The inconsistency is likely a result of the diverse undergraduate experiences of the teachers and influenced by their opportunities to learn or not learn the appropriate handwriting teaching methodologies in their undergraduate experience. The injustice is imbedded in the notion that teachers may not be accessing equal and fair privileges for learning the teaching methodologies. As a result, children within one school district may be taught different handwriting methods, or may experience varying handwriting expectations. This injustice impacts the child, the next year's teacher and the occupational therapist working

with various teachers, because of the variations in instruction and evaluation (Asher, 2006).

The type of occupational therapy service delivery model may produce positive handwriting outcomes for the child, regardless of the type. However, the literature illustrated that the preferred type of service delivery models and the actual model of service delivery provided is incongruent. This may lead to an occupational injustice for the teacher or the occupational therapist. If meaningful and client-centered occupations lead to an occupational justice, then the injustice may be imbedded in the fact that the professional is not providing or receiving their personal preferred method of service delivery.

The occupational therapy literature on the assessment and treatment methods for handwriting also illustrated inconsistent findings. This included the type of evaluation methods used to assess handwriting; either evaluation based on the functional components or the performance components, which are thought to impact handwriting. This also included the occupational therapy treatment approaches and modalities used for handwriting intervention. Because handwriting is a major reason for referral to occupational therapy, occupational therapists are likely to spend a majority of their time engaged in the assessment or treatment of handwriting. However, the inconsistencies identified in the occupational therapy handwriting literature may result in the role of the occupational therapists in assessing and treating handwriting as not being valued and perhaps meaningless. Thus leading to a potential condition contributing to an occupational injustice.

As previously established, occupational therapists have valuable knowledge and resources on handwriting to provide children and teachers. A lack of school-based occupational therapists to children ratio was identified in the introduction. This condition may contribute to an occupational injustice for the child, the teacher and the occupational therapist. The injustice is embedded in the lack of occupational therapy intervention being provided to children with handwriting problems or occupational therapy consultation

being provided to teachers due to the decreased numbers of contracted occupational therapists to need, ratio.

Lastly, assessments involving the child's or teacher's personal perception of handwriting quality were limited. This may lead to conditions of an occupational injustice because the child's or teacher's perceptions may not be considered, illustrating practice methods that are not inclusive of client-centeredness. As previously established, client-centered engagement in meaningful occupations leads to conditions of occupational justice, the alternative would lead to conditions of occupational injustice.

Four major factors which may contribute to conditions of an occupational injustice were described. These factors provide valuable insights into the occupation of handwriting. Without the use of the *Revised Framework of Occupational Justice* or the integrative review methodology, these insights may not have been identified nor expressed.

6.3 The Revised Framework Of Occupational Justice

The Framework of Occupational Justice describes an exploratory process of the structural and contextual factors leading to conditions of occupational justice or injustice. However, as a result of categorizing the literature sources, it was identified that there were factors and features that were missing, specifically *occupation factors* and *occupational interactions*. A summary of the evolution of the framework to create the revised framework and the reasons for including additional factors was provided.

Occupational justice is differentiated in the literature from social justice by the inclusion of occupations and the premise that all individuals have the right to engage in health building occupations, as described in these two quotes (1) "Occupational justice diverges from social justice through an interest in individual as well as group differences; a concern for the enablement of diverse participation in society as well as the distribution of rights and goods; and a focus on the relationships between occupation, health, and quality of life" (Stadnyk et al., 2010, p. 331), and (2) "Social justice overlooks injustices related

to participation in daily life occupations- injustices related to doing instead of having" (Townsend, 2003, p. 12). However, the Framework of Occupational Justice (Stadnyk, 2010) does not graphically identify, nor describe, the occupation described within these two quotes.

The framework of occupational justice is described as an exploratory process of reasoning; therefore it is plausible that questions regarding who, what, where, when and why should be addressed within the structure to better understand the conditions which might lead to an occupational injustice. As indicated earlier, the *structural factors* are reported to regulate *where, when, with whom* and *how* occupations can occur, while the *contextual factors* describe the individual's, social and cultural characteristics in context of the occupation. However, the *why* and *what* are not addressed within the framework. It was proposed that the "why" of the occupation refers to the outcome of occupational justice: to promote meaning, choice, balance and participation within the occupation. And the "what" refers to the occupation.

The literature sources collected on handwriting supported this. The "what" missing from this exploratory process referred to the *occupation*. "What" occupation is the individual, community or nation experiencing an occupational injustice in? Or "what" components make up this occupation? The absence of the occupation within the Framework of Occupational Justice, does not illustrate the main reason for exploring the injustice in the first place: "when participation in daily life *occupations* [emphasis added] is barred, confined, restricted, segregated, prohibited, undeveloped, disrupted, alienated, marginalized, exploited, excluded, or otherwise restricted" (Townsend, 2003, p. 9). Also, the profession of occupational therapy purports occupation to be the domain of concern (Polatajko, Townsend, & Craik, 2007 in Townsend & Polatajko, 2007). Therefore, it was plausible then, that the research conducted within the field of occupational therapy, collected for this review, would focus solely on the occupation. The addition of the *occupation factor* would provide an introduction to, and an examination of, the occupation and build on the exploratory process of occupational justice.

In addition, the Framework of Occupational Justice does not provide a separate section to describe interactions that occur between the structural and/or contextual factors and the occupation factors. However, the literature on the framework, was found to document an *interaction* between structural and contextual factors as described in these two quotes: (1) "occupational determinants and forms *interact* [emphasis added] with the contexts of individuals, groups or communities to produce occupational outcomes related to occupational justice or injustice" (Stadnyk et al., 2010, p. 335) and (2) "structural factors, in *interaction* [emphasis added] with personal context, can create conditions of occupational justice or injustice" (Stadnyk, 2007, p. 82). The interaction that is described in these quotes is not graphically illustrated within the diagrammatic Framework of Occupational Justice. The lack of the interaction in a visual form downplays the importance of this interaction. In addition, all seventy-five sources collected, described the interaction between the occupation and the *structural* and or *contextual factors*. This supported the need to include *occupational interactions* in the *Revised Framework of Occupational Justice.*

Adding the *Occupational Interactions* factor to the framework captures the dynamic interaction between the structural and contextual factors, and the occupation factors. This factor is an amalgamation of the myriad of influences that affect the occupation. It illustrates that numerous structural contextual and occupational factors interact. As a result of the multiple types of interactions, many individuals may experience an occupational injustice. An example illustrating this from within this integrated review is that the child and the occupational therapist may experience an occupational injustice due to their personal interaction with the occupation of handwriting. The injustice for the child may be the result of a contextual factor, such as the child's ability/disability, or a structural factor, such as lack of health or community supports. Alternatively, the injustice for the occupational therapist may be a result of a structural factor, the lack of program support or time to provide handwriting interventions or to identify research on evidence-based practice methods for handwriting intervention, etcetera.

As a result of using the *Revised Framework of Occupational Justice*, the literature sources support the occupation of handwriting in the school system is a trifecta situation; the teacher must teach handwriting, the student must learn the skills to produce functional handwriting, and the occupational therapist must support both the student and the teacher when this progression falters. Thus, the exploratory occupational process of handwriting involves the (1) structural factors: the environment, health and community supports and the invisible hierarchies of power, rules, policies and funding values, which influence the existence of these occupational forms (2) the contextual factors: the child and his or her biological, social or cultural influences and (3) the occupation: the components, which make up the skills enabling a child's engagement and participation. While, (4) the occupational interaction: is the interaction of the child, teacher, and occupational therapist with the occupation of handwriting. The occupational interactions between the factors was essential to develop a clear understanding of the complexities of handwriting and the conditions which might lead to an occupational injustice.

As well, during the integrative review process, associations between the *Revised Framework of Occupational Justice* and the Canadian Model of Occupational Performance and Engagement CMOP-E (Polatajko et al. 2007) were observed, as a result of evaluating the literature sources. For example, the CMOP-E conceptualizes occupational performance as the dynamic interaction of person, occupation and environment (Polatajko et al.) while the *Revised Framework of Occupational Justice* conceptualizes the structural factors (programs & environment) and the contextual factors (unique to the individual).

Associations were also observed between the *Revised Framework of Occupational Justice* and the International Classification of Functioning, Disability and Health (ICF: World Health Organization, 2010). The identification of the *activities and participation* (ICF) is parallel to the addition of the *occupation factors* and the *occupational interactions*. Additionally, the *occupation factor*, for the purpose of this review, is similar to the "occupation" domain within the CMOP-E (Polatajko et al., 2007).

However, it is also important to identify how the *Revised Framework of Occupational Justice* differs from these models. The *Revised Framework of Occupational Justice* provides the individual using the framework with a valuable, systematic process to critique the factors that may be creating conditions of occupational justice or injustice. It is based on a critical research perspective. Therefore, the outcomes of occupational justice may be determined by evaluating the achievement of the individual's occupational rights, or by identifying outcomes of dis-ease or outcomes of injustice. The evaluation of the outcomes in relation to the factors may also provide a practical tool for identifying strengths, limitations and factors for change. The framework is a practical tool that may be easily used, based on the occupational justice paradigm. The CMOP-E nor the ICF are not structured for the purposes of identifying the conditions leading to an occupational justice or injustice or for taking a critical research perspective.

6.3.1 Occupational Injustice

As described in the methods section, the *Revised Framework of Occupational Justice* was envisioned as one model. Two figures, which visually illustrated the conditions leading to an occupational justice or injustice, were provided within the body of this thesis. Two additional figures, (see Figures 6.10 and 6.11) are provided to visually demonstrate the other possible visual configurations of the model that may also illustrate conditions leading to an occupational injustice. The only differences in the examples provided here compared to the example of occupational injustice provided in the body of the thesis are in the conditions leading to an occupational injustice, particularly the inclusion/exclusion of the darkened versus clear rectangles/bridges.

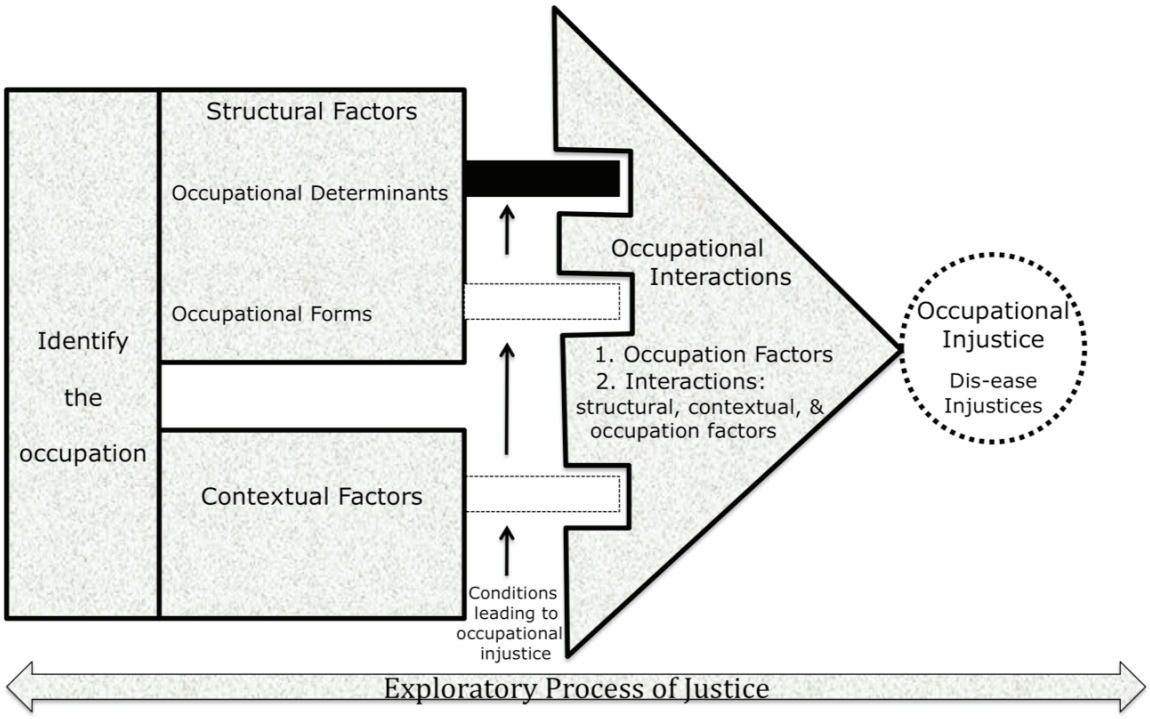

Figure 6.10 Conditions leading to an occupational injustice

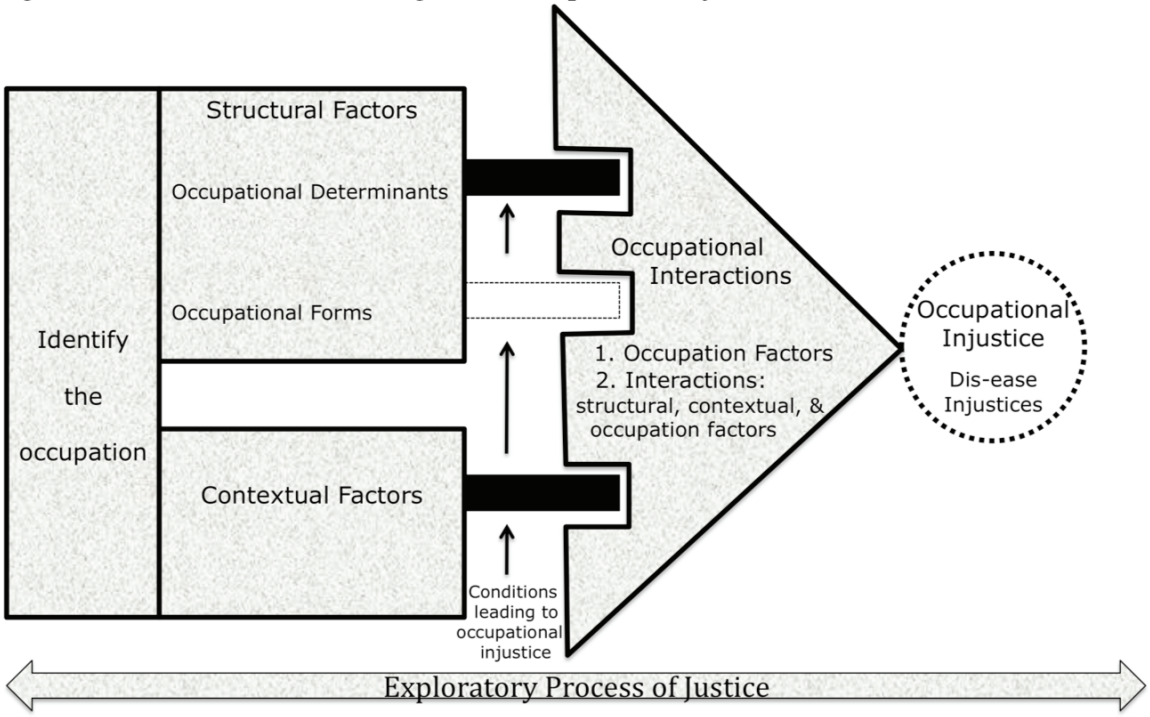

Figure 6.11 Conditions leading to an occupational injustice

6.4 Implications For Occupational Therapy Practice

The seventy-five literature sources analyzed using the *Revised Framework of Occupational Justice* contributed to a further understanding of handwriting and resulted in occupational therapy implications for practice.

The literature revealed that an occupational therapists role includes both the assessment and intervention of, as well as, advocating for meaningful client-centered occupations. It is recommended that occupational therapists advocate for the inclusion of an occupational therapist to consult on the development of the educational handwriting curriculum outcomes and occupational therapy position statements, guidelines for handwriting practice, and supportive documentation for the public and professionals.

Occupational therapists who practice in school-based roles should be aware that the literature on the typical development of handwriting quality and speed is not consistent with regards to the impacts of population, age, and gender. Generally, handwriting was found to develop pre or post kindergarten and boys may be identified for handwriting problems more often, even though gender was not consistently associated with handwriting ability. Occupational therapists should also be aware that there is an inverse relationship between handwriting speed and legibility (Ziviani and Watson-Will, 1998). Therefore, if a referral for handwriting speed is initiated the occupational therapist should first determine the quality of the handwriting and address concerns prior to addressing concerns with quantity.

Six medical diagnoses were identified within the occupational therapy literature on handwriting in the past fifteen years including: mild motor difficulties/ developmental coordination disorder, perceptual and motor weaknesses, cerebral palsy/ hemiplegia, preterm births, attention deficit hyperactivity disorder and learning disabilities. It is suggested that occupational therapists be aware that a referral for a child with one of these identified diagnoses may be strongly associated with school-based functional challenges, particularly including handwriting problems; however, the list of six diagnoses are not considered to be inclusive. Children may or may not have a medical diagnosis or an

individual program plan, but may have identified handwriting problems. It may also benefit the therapist to know that the handwriting problems identified are similar to those problems a typically developing child may experience, however the severity and probability of handwriting problems are higher in children with these medical diagnoses. Occupational therapists may primarily identify the impacts of sensorimotor skills and cognition, while observing secondary impacts on psychosocial skills as a result of these handwriting problems. Functional, sensorimotor and cognitive skills may be primarily targeted in handwriting intervention but because occupational therapy is considered holistic, it is equally as important that the occupational therapist address the psychosocial and environmental impacts as the result of handwriting problems.

Occupational therapists also need to be aware that the definitions of handwriting quality, and expectations of service delivery and intervention vary from teacher to teacher. Therapists should establish clear definitions with the teacher prior to their involvement. This will also support the collaboration between the occupational therapist and the teacher and as a result, positively impact the child's outcomes.

Furthermore, occupational therapists will be better suited for providing handwriting intervention, if the educational handwriting curriculum outcomes are known and a comprehensive foundation of knowledge is established on the handwriting functional and performance components. Clinical reasoning and evidence-based practice were identified as two essential skills. The development of these skills is limited by: time, resources and experience. However, occupational therapists may be proactive by learning about the published clinical-decision making tools/frameworks for occupational therapy handwriting practice. And given the robust amount of literature on handwriting; the study identified seven sound literature reviews published on evidenced-based handwriting practices, occupational therapists could also review these. This would increase the opportunity for evidence-based practice and therefore expertise because the information on handwriting is concentrated into a few manageable publications. In addition, the occupational therapist should also be aware that the service delivery model may not necessarily impact the handwriting outcomes; rather, each model has been found to

provide unique strengths and weaknesses. It is suggested that the therapist maintain the type of service delivery model mandated by the employer.

There is an abundance of occupational therapy evaluations which focus on assessing the functional, and performance component skills of handwriting. Occupational therapists should be aware of the psychometric properties of the handwriting evaluations and the various types of formal and informal evaluations available. Given the inconsistencies within the literature, no one functional or performance component assessment is considered the gold standard. Therefore, handwriting evaluations should include various assessment methods, including: observation of handwriting in different environments and in different performance areas, functional and performance component evaluations and teacher and student report of handwriting concerns and perceptions of strengths and weaknesses. The teacher and student report should be the overruling outcome if the assessments outcomes do not correlate with teacher and student report. This will ensure meaningful client-based practice is maintained.

Occupational therapists should also be aware that the main types of service provision identified within the literature over the past fifteen years include: remedial, functional, compensatory and adaptive. Because the best type of treatment intervention is not known, the most appropriate treatment for handwriting problems include client-centered, meaningful and culturally relevant interventions. Lastly, because the history of handwriting (manuscript writing) and technology have evolved as a symbiosis over the years, occupational therapists need to be aware of the strengths and weaknesses of each form of written output and recommend the most appropriate type of written output based on the child's needs and availability of support and funding.

6.5 Implications For Use Of The Revised Framework Of Occupational Justice In An Integrative Review Methodology

Combining the integrative review methodology and the theoretical *Revised Framework of Occupational Justice* to guide the occupational therapy literature findings on handwriting

was opportune. The Revised Framework of Occupational Justice contributed to further our understanding of occupational justice through the addition of the factors and features described. The outcomes of the study as a result of using an occupational justice lens reinforced the important contribution occupational justice, as a foundational pillar of knowledge, has to offer the practice of occupational therapy. In addition, using the *Revised Framework of Occupational Justice* as a tool to critically review the occupational therapy literature on handwriting from a critical worldview perspective was unique.

The methodology encouraged a diverse collection of literature from past empirical and theoretical sources, which were matched to the *structural, contextual, occupational*, and *occupational interactions factors* from the revised framework. Integrative reviews are notorious for lacking in methodological rigour and fidelity. However, this research illustrated that using the critical appraisal tools developed, would provide a systematic and methodological process to increase the rigour and fidelity of the findings. In addition, using a diverse sample frame allowed for a comprehensive collection of empirical and theoretical knowledge to be obtained.

The methodology and the occupational justice framework together identified themes in the literature, which may have not otherwise have been noted, such as the predominance of one type of research paradigm over the other. In addition, in systematically breaking down the factors involved in the occupation of handwriting through the integrative review process, a more comprehensive understanding of handwriting and the conditions leading to occupational injustice of handwriting were identified.

6.6 Limitations

The limitations identified within this integrated review were divided into two components: theoretical limitations and methodological limitations. The theoretical limitations are presented first.

6.6.1 Theoretical Limitations

The theoretical limitations regarding the need for the addition of the two new factors and two features have been previously described in findings chapter of the thesis. Another limitation is that the use of the Framework of Occupational Justice has not been previously used to direct an integrative review study. Therefore the interpretation of how to use the revised framework within this type of research methodology is subjective. Other interpretations of the application of the framework within the methodology may exist. The terms and definitions used to describe the factors, specifically, the "occupational determinants" and "occupational forms" are awkward terms to use in practical context and may be challenging for an individual to understand if they are not familiar with the exploratory theory of occupational justice or the framework. Another limitation is that various models on the framework of occupational justice are located within the literature. Identifying the most appropriate model to use was a challenge.

6.6.2 Methodological Limitations

The methodological limitations of the integrated review were identified in the next three sections.

6.6.2.1 Methodological Limitation 1

The predetermined search strategy specifically the search terms and the inclusion/exclusion criteria restricted the collection of all available sources on the occupational determinants. The inclusion/exclusion criteria resulted in the exclusion of significant literature sources, specifically, those which would have contributed to a greater understanding of the structural factors impacting handwriting. The structural factors, such as the policies that govern health and education, the values that are inherent in the organizations, the funding matrices and the explanations for resource distribution inherently, were not identified within the occupational therapy literature findings. For example, the Canadian Association of Occupational Therapists (CAOT) published a position statement: Occupations and Health (2008) (an occupational determinant), that governs occupational therapy practice. However, this position statement was not

identified using the predetermined search strategy because the term handwriting was not identified within the title, keywords or abstract of the significant sources describing structural factors. Although this was considered to be an important occupational determinant, it was excluded due to pre-determined inclusion/exclusion criteria.

This was also observed with other assumed structural factors such as, the visions of occupational therapy, school-based occupational therapy position statements, teaching position statements, education and health policies etcetera. The literature on the structural factors, particularly the occupational determinants impacting the conditions of occupational justice or injustice, by the nature of the methodology employed, was not adequately represented in the integrative review.

In addition, the search strategy completed using additional search terms for the Departments of Education and the occupational therapy organizations identified literature sources, but these were excluded due to methodology (inclusion/exclusion criteria).

There were other limitations due to the predetermined search strategy. The occupational therapists that published literature sources within countries that did not meet the language criteria in this integrated review, such as in Israel, China, Netherlands, etcetera were not included and limited the scope of this review. Also, the inclusion of only occupational therapy literature limited the understanding of handwriting and the range of possible factors contributing to the occupational injustice because a review of the education, psychology, physiotherapy and kinesiology literature sources were not included. Finally, grey literature sources, which may have been identified from other countries, were excluded; for example, the literature sources on the government policies of handwriting in other countries such as USA and Australia were excluded. Using only the Canadian grey literature limited the scope of this review.

6.6.2.2 Methodological Limitation 2

Although every attempt was made to standardize the Publication Questionnaires and the URDC Evaluation Tools, these tools were subjective because they relied on personal

judgment. They were also not sensitive to slight variations of change. For example, a literature source was either described as having high utility for a score of one point or low utility for a score of zero points. There was no medium utility identified. Therefore the ordinal scale lacked sensitivity.

In addition, the quality-rating criterion: utility, which was developed for the purposes of the integrative review, was grounded in a positivist research worldview. The utility of the literature sources were based on a subjective, therapist perspective of the literature findings. However, because occupational justice and the framework are derived from a critical research perspective, the definition for utility, as it currently is defined, would not rate the information on the social structural factors possibly identified to be "useful".

6.6.2.3 Methodological Limitation 3

The thesis format for presenting the integrative review is not consistent with the prescribed format for an integrative review. Specifically, in the integrative review, the identification and evaluation of literature sources would have been characterized within the methodology section, whereas within the thesis framework, this information is described within the results section (chapter 4 and 5). In the findings section of an integrative review, an integration of the literature is provided without description of how many literature sources were collected. This format would not have provided enough information on the rigour of the method employed, which is important for the thesis; therefore it was included in the findings section. As a result, this integrative review is presented in a format that meets the requirements of a thesis and may not be illustrative of the true integrative review research methodology.

6.7 Implications For Future Research

Firstly, because there are limited published sources on the occupational justice framework and because a *Revised Framework of Occupational Justice* was found to be beneficial in identifying the conditions contributing to occupational injustice, further research on the

practical use of the framework is needed. In addition, because the revised framework was created to analyze the conditions of occupational injustice from different perspectives such as from a literature research perspective or from an individual report, further research on the utility from various perspectives is also required.

The research paradigms used in the past fifteen years were mainly limited to quantitative research. The breadth of the research paradigms found was limited. The occupational therapy literature on handwriting may benefit from more diverse research methodologies such as qualitative or mixed method designs. More diverse research methodologies may result in more comprehensive literature findings, particularly because handwriting is a complex, and multifaceted occupation. Additionally, it may be warranted to advocate that occupational therapists publish their research findings on handwriting, regardless of the outcomes of their study to further contribute to the depth and breadth of the literature sources.

Given the identified gaps in the literature findings and the identified limitations in the research methodology, further research identifying the structural, contextual, occupation and occupational interactions factors contributing to the conditions of an occupational justice in handwriting is recommended. Such research could include diverse literature sources from a multitude of professions, countries and languages to better understand the occupation of handwriting and the conditions contributing to an occupational injustice. Also, based on the literature findings, further research illustrating the actual barriers to translating this knowledge into current occupational therapy and teacher practice is warranted.

It is also recommended that further research on the implications of the occupational determinants, specifically educational and occupational therapy position statements, guidelines and values on handwriting, pediatrics and models of service delivery are warranted. In addition, research on the handwriting curriculum expectations across Canada is warranted. Further research on analyzing the handwriting curriculum outcomes across Canada was initiated and presented in Appendix AE.

Additional research on the contextual factors impacting handwriting outcomes is also warranted. This would include more research on the identified six medical diagnoses as well as other diagnoses not identified, such as autism and non-verbal learning disabilities, etcetera.

Lastly, further research on the evaluation and intervention methods of occupational therapy is warranted. This is due to the inconsistencies identified within the literature sources on the practices of occupational therapists and handwriting interventions.

6.8 Summary Of Thesis

This review is unique from all other studies on handwriting because it uses an integrative review design, a diverse sampling method, a research perspective, and the *Revised Framework of Occupational Justice* for purposes of better understanding the occupation of handwriting and to identify factors and conditions contributing to the occupational injustice.

The integrative review methodology, using the critical appraisal tools developed, offered an equally rigorous but a more comprehensive perspective of handwriting than a systematic review would. This is because an integrative review encourages all types of research paradigms and literature sources to be evaluated and analyzed for a better understanding of the phenomenon or problem. Based on the outcomes of this integrative review, the *Revised Framework of Occupational Justice* was identified as a valuable and practical tool to explore real clinical conditions contributing to conditions of an occupational justice or injustice. The complexities of the interactions between the identified *structural, contextual, occupation* and *occupational interactions factors* contributed to a comprehensive understanding of the occupation of handwriting. As a result of the *occupational interactions*, identified within the seventy-five literature sources obtained, it was concluded that a child, teacher, and an occupational therapist might experience an occupational injustice in handwriting.

In conclusion, this integrative review reinforced the notion that handwriting is a meaningful and complex occupation. Potential conditions contributing to conditions of occupational injustice have been explored. Gaps in the occupational therapy literature on handwriting highlight areas for further occupational therapy research and advocacy. As occupational therapists, we must continue to consider the occupational rights of a child, provide meaningful and culturally relevant handwriting interventions, and advocate for occupational justice. It is proposed that the development of the skills required to engage in the school-based occupation of handwriting, through equal access to opportunities and resources, is an occupational right for all children within the school system.

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APPENDIX A COPYRIGHT PERMISSION LETTERS

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- Figure 13-2, p.336, A Framework of Occupational Justice, R.L.Stadnyk.

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- Figure 11-3, p.251. An exploratory theory of occupational justice: occupational determinants, forms, and outcomes of occupational injustice

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APPENDIX B STATISTICAL CALCULATIONS

I came to the estimation found in the introduction, by combining two main sources:

1. Statistics found within handwriting articles
2. Statistics on Canadian Population and Health Professionals

Statistics found in Handwriting Articles

1. "Estimates have been as high as 44% for children attending schools in urban areas" (Graham & Weintraub, 1996, p. 39)
2. 98% of the school based occupational therapists, receive referrals for handwriting (Tait, 1998)
3. The most common reason for referral to school based occupational therapy is due to handwriting problems (Benbow, 1995; Cermak, 1991; Chandler, 1994; Cunningham-Amundson & Crowe, 1993; Oliver, 1990; Reisman, 1991; Schneck & Henderson, 1990; Tseng & Cermak, 1993).
4. "Only 12% of teachers indicated their preparation was adequate" (Graham et al., 2008, p. 63), regarding teacher's perspectives of their preparation for instructing handwriting.

Statistics on Canadian Population and Health Professionals

1. Statistics Canada reported in 2006 approximately 29, 201, 310 children were reported to be living with families.
2. The Canadian Institute for Health Information (CIHI) reported there were approximately: 11, 786 Occupational Therapists registered in Canada in 2006.
3. A report by Canadian Institute for Health Information (CIHI) titled *Workforce Trends of Occupational Therapists in Canada, 2006* indicated that approximately 5.5% of Occupational Therapists reported their primary employer to be "School or School Board" in 2006.
4. *The Development of an Interprofessional Caseload Management Planning Tool in Occupational Therapy, Physiotherapy and Speech-Language Pathology in Canada* (Burnett & Klaiman, 2009) referenced Spencer, 2006 findings that the average school-based OT caseload was 43.68 children.

Given these identified factors, an approximation of how many children would likely not receive OT services, per year may be calculated.

1. 648 occupational therapists were working in the schools, in Canada, in 2006 (5.5% multiplied by 11, 786 registered OTs, in 2006).
2. 12 848 576 children will struggle with handwriting to some extent (44% of total number of children in Canada as of 2006 (29, 201, 310).
3. Approximately 28 304 students will been seen by school-based OTs (based on average caseload (43.68) multiplied by number of OTs working in/for schools (648))
4. Therefore, **12, 820, 272** are struggling with handwriting, without the support of an occupational therapist.
5. To put this injustice into perspective, the population of children with handwriting problems who are not accessing OT is larger then the population of Greece (Jan,1 2010 Greece Population is 11 306 183).

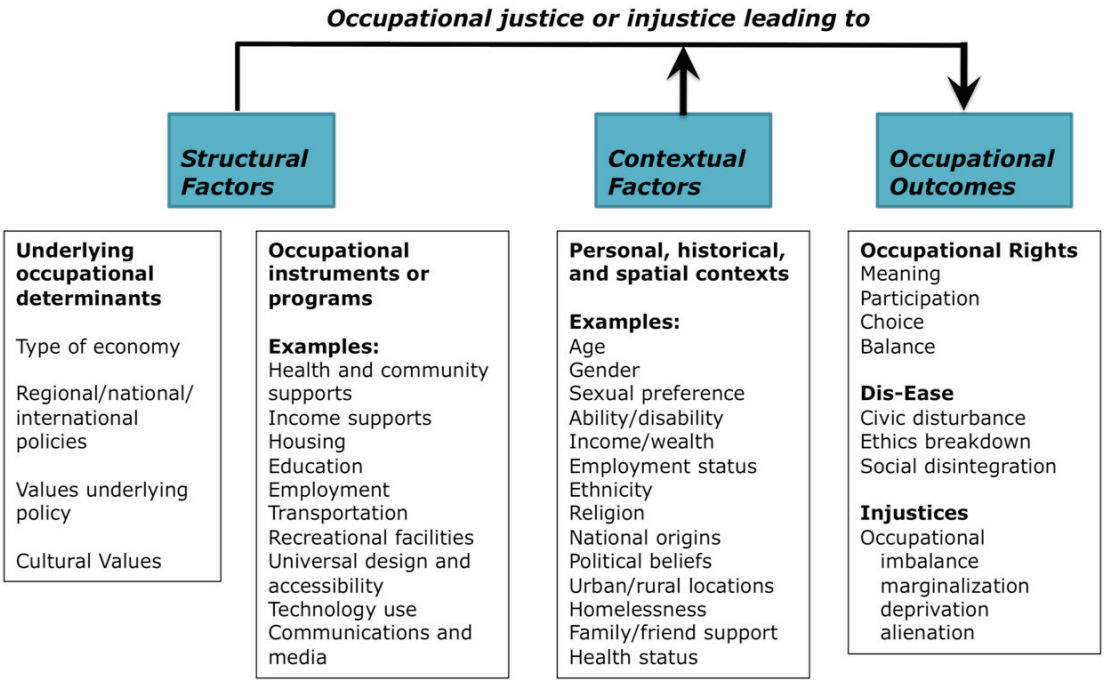
APPENDIX C CHARTER OF OCCUPATIONAL RIGHTS

Charter of Occupational Rights (Townsend & Wilcock, 2004b)

Charter of Occupational Rights			
Right to experience occupation as meaningful and enriching	Right to develop through participation in occupations for health and social inclusion.	Right to exert individual or population autonomy through choice in occupations.	Right to benefit from fair privileges for diverse participation in occupations.

APPENDIX D FRAMEWORK OF OCCUPATIONAL JUSTICE

Framework of Occupational Justice (Stadnyk, 2010).



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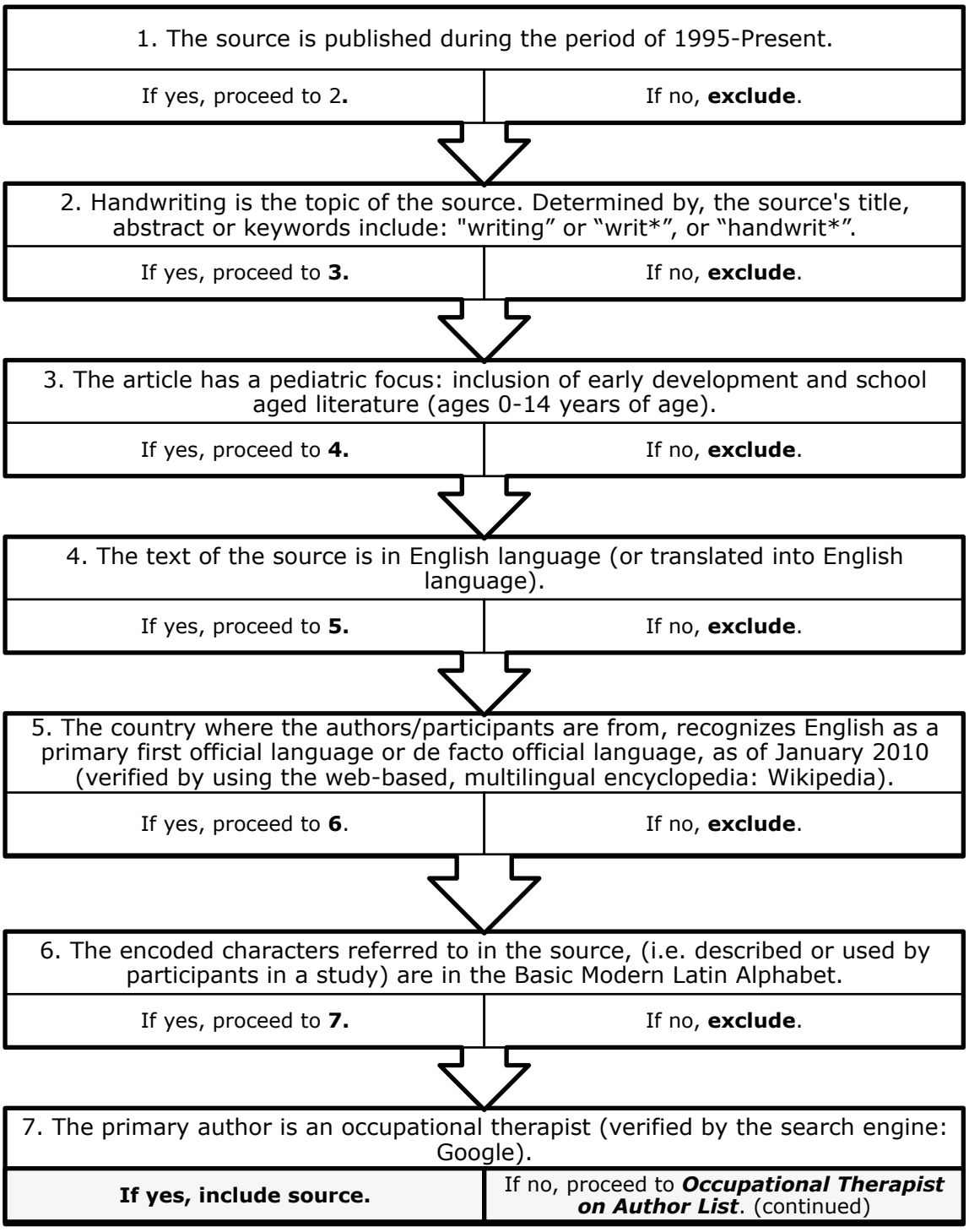
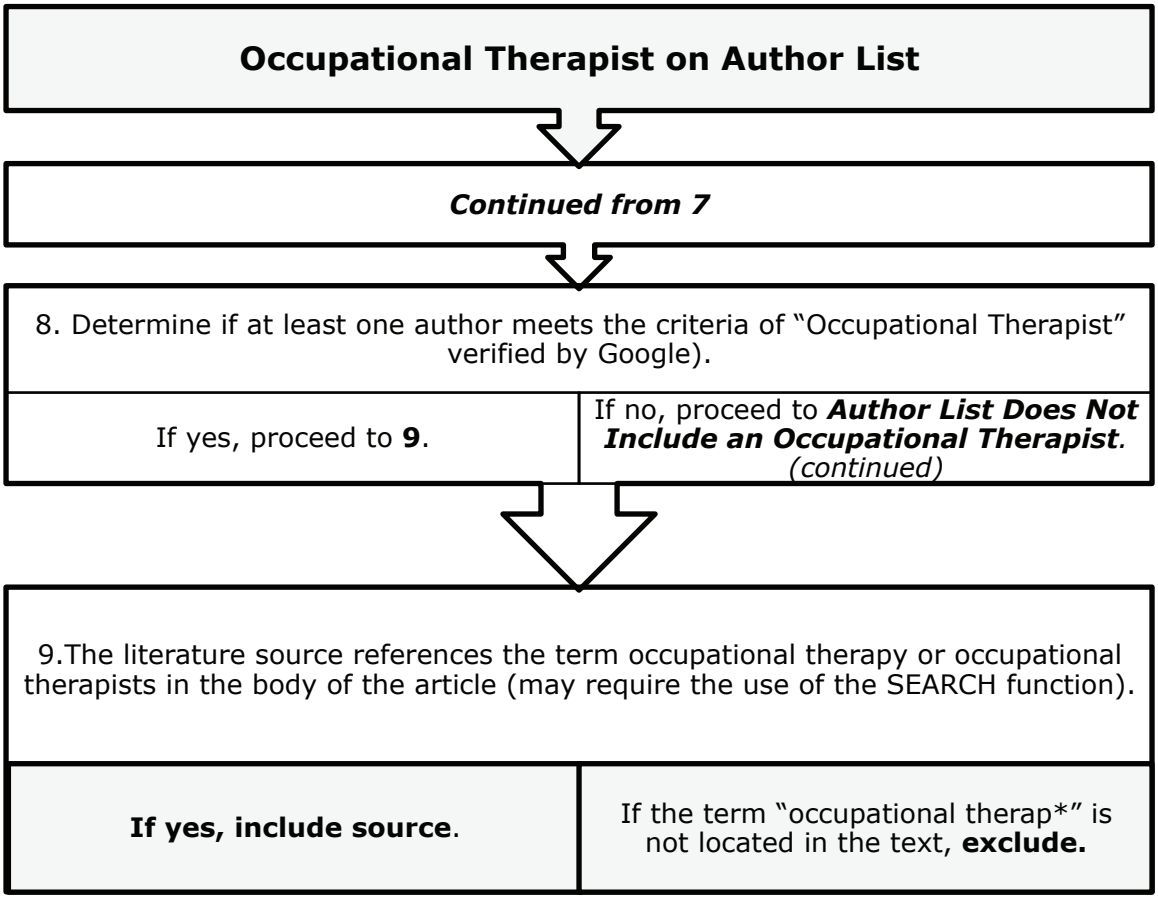
APPENDIX E DECISION TREE: SELECTING SOURCES

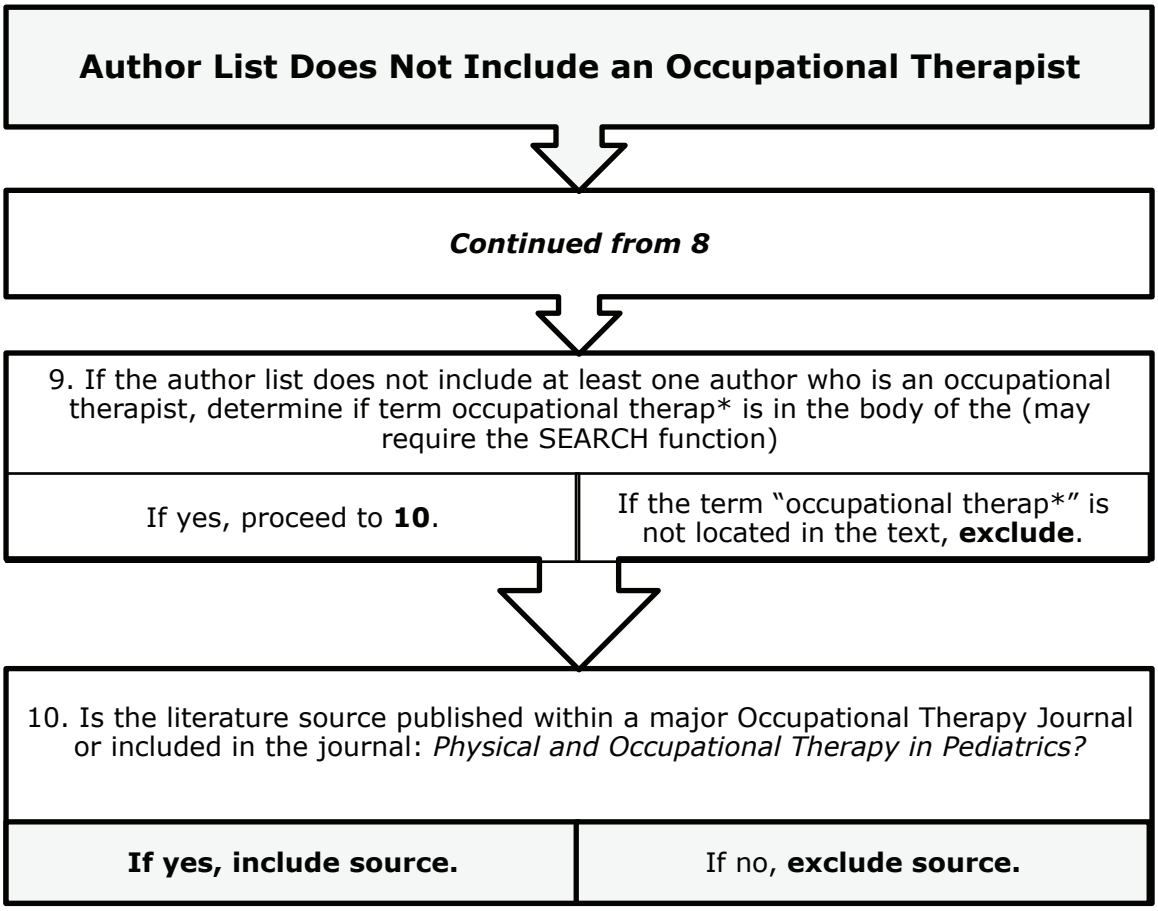
STAGE ONE: INCLUDING SOURCES



STAGE ONE: CONTINUED

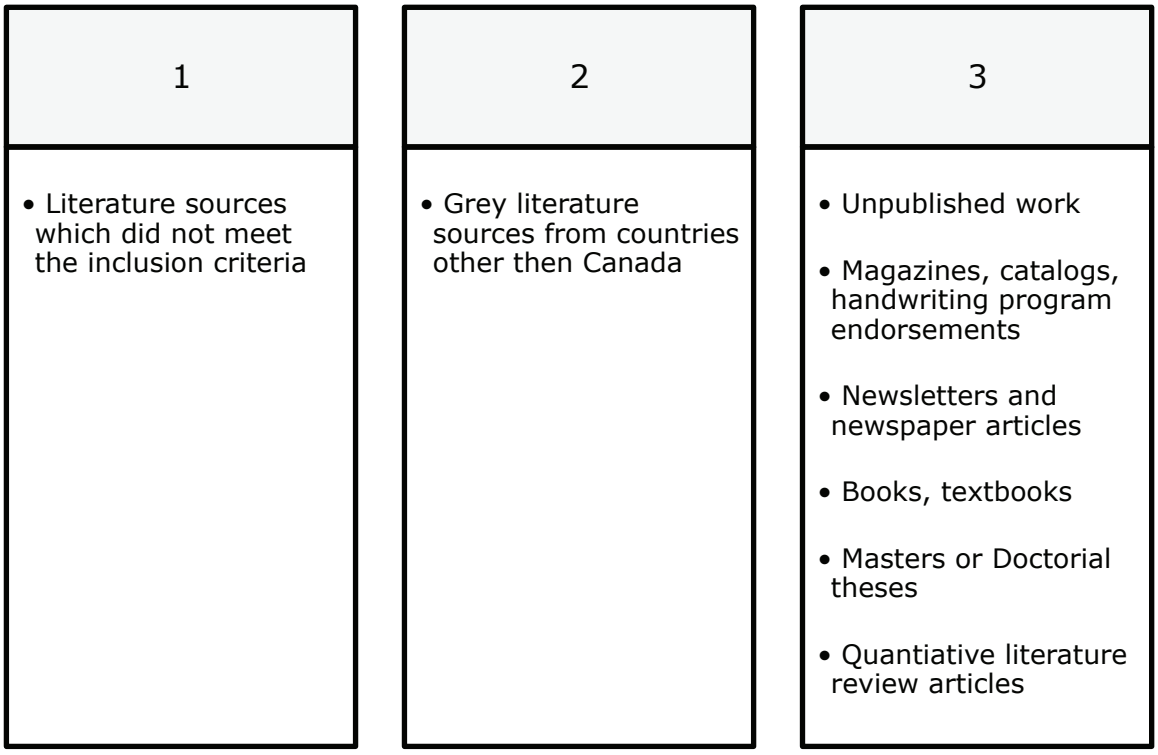


STAGE ONE: CONTINUED



APPENDIX F DECISION TREE: EXCLUDING SOURCES

Three Types of Excluded Sources



APPENDIX G CATEGORIZING SOURCES

Sources were categorized in consistent fashion based on (1) *Publication Type/Design Characteristic* and (2) *Factor Type/Characteristics* and descriptions

(1) *Publication Type/Design Characteristics*

Type 1	Type 2	Type 3	Type 4	Type 5
• Qualitative	• Quantitative	• Mixed Methods	• Psychometric Analysis	• Alternative

(2) *Factor Types/Characteristics*

Descriptive words to describe the source content were also included.

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
• Structural Factors: Occupational Determinants	• Structural Factors: Occupational Forms	• Contextual Factors	• Occupation Factors	• Occupational Interactions

APPENDIX H GRADE SYSTEM: QUANTITATIVE SOURCES

PUBLICATION QUESTIONNAIRE-QUANTITATIVE STUDY DESIGN
Based on Critical Review Form-Quantitative Studies, (Law, et al., 1998)

Title:
Author:

1. Was the purpose stated clearly?	**y**/n
2. Was relevant background literature reviewed?	**y**/n
3. Was the study design described?	**y**/n
4. Was the design appropriate for the study?	**y**/n
5. Were ethical issues to the study design avoided?	**y**/n
6. Were biases in the study design avoided?	**y**/n
7. Was the sample described in detail?	**y**/n
8. Was the sample size justified?	**y**/n
9. If there were biases in the subject selection, were they justified?	**y**/n
10. Was informed consent obtained?	**y**/n
11. Were the outcome measures reliable?	**y**/n
12. Were the outcome measures valid?	**y**/n
13. Was the frequency of the outcome measurement reported?	**y**/n
14. Was the intervention described in detail?	**y**/n
15. Was contamination avoided?	**y**/n
16. Was co-intervention avoided?	**y**/n
17. Could the intervention be replicated in OT/School-based practice?	**y**/n
18. Were the results reported in terms of statistical significance?	**y**/n
19. Were the analysis methods appropriate?	**y**/n
20. Was clinical importance reported?	**y**/n
21. Were drop-outs reported?	**y**/n
22. Were conclusions appropriate given study methods and results?	**y**/n
23. Were the implications for OT/School-based practice reported?	**y**/n
24. Were the main limitations or biases in the study reported?	**y**/n

TOTAL Yes: ___/24

Inclusion/Exclusion **INCLUDE ☐**
Include in the study if **at least 50% or ≥ 12** questions answered yes
Exclude from the study **if ≤ 11** questions answered yes

GRADE SYSTEM: Quantitative Sources, *Continued*

URDC EVALUATION TOOL

Study Utility Score (U)
1 point if considered to have high Utility to OT/School-Based Practice
0 point if considered to have low Utility to OT/School-Based Practice

TOTAL U Score: ____/1

Study Relevancy Score (R)
1 point if considered high relevance to the Integrative Review
0 point if considered low relevance to the Integrative Review

TOTAL R Score: ____/1

Study Design/Content Score (D/C)
1 point if at least 75% or if ≥18 questions were answered "yes"
0 point if 50% -74% or 12-17 questions were answered "yes"

TOTAL D/C Score: ____/1

FINAL GRADE:____ /3

APPENDIX I GRADE SYSTEM: PSYCHOMETRIC SOURCES

PUBLICATION QUESTIONNAIRE- PSYCHOMETRIC SOURCES
Based on Critical Appraisal of Study Design For Psychometric Articles (MacDermid, 2007)

Title:
Author:

1. Was relevant background literature reviewed? **y**/n
2. Were appropriate inclusion/exclusion criteria defined? **y**/n
3. Were specific psychometric hypotheses identified? **y**/n
4. Was an appropriate scope of psychometric properties considered? **y**/n
5. Was an appropriate sample size used? **y**/n
6. Was appropriate retention/follow-up obtained? **y**/n
7. Were specific descriptions provided of the techniques used to collect measurements reported? **y**/n
8. Did measurement procedures use standardized techniques to minimize potential sources of error/misinterpretation in the individual measures taken within the study? **y**/n
9. Were analyses conducted for each specific hypothesis or purpose? **y**/n
10. Were appropriate statistical tests conducted to obtain point estimates of the psychometric property? **y**/n
11. Were appropriate ancillary analyses done to describe properties beyond the point estimates? **y**/n
12. Were the conclusions/clinical recommendations supported by the study objectives, analysis, and results? **y**/n
13. **Could the assessment be used in OT/School-based practice?** **y**/n
14. **Were the implications for OT/School-based practice reported?** **y**/n

TOTAL Yes: ___/14

Inclusion/Exclusion
Include in the study if **at least 50% or ≥ 7** questions answered yes **INCLUDE** ☐
Exclude from the study **if ≤ 6** questions answered yes

GRADE SYSTEM: Psychometric Sources, *Continued*

URDC EVALUATION TOOL

Study Utility Score (U)
1 point if considered to have high Utility to OT/School-Based Practice
0 point if considered to have low Utility to OT/School-Based Practice

TOTAL U Score: ____/1

Study Relevancy Score (R)
1 point if considered high relevance to the Integrative Review
0 point if considered low relevance to the Integrative Review

TOTAL R Score: ____/1

Study Design/Content Score (D/C)
1 point if at least 75% or if ≥11 questions were answered "yes"
0 point if 50% -74% or 7-10 questions were answered "yes"

TOTAL D/C Score: ____/1

FINAL GRADE:____ /3

APPENDIX J GRADE SYSTEM: QUALITATIVE SOURCES

PUBLICATION QUESTIONNAIRE: QUALITATIVE SOURCES
Based on Critical Review Form-Qualitative Studies (Letts, et al., 2007)

Title:
Author:

1. Is the purpose and/or research question clearly stated? **y**/n
2. Was relevant background literature reviewed? **y**/n
3. Was the study design reported? **y**/n
4. Was a theoretical perspective identified? **y**/n
5. Was the process of purposeful selection described? **y**/n
6. Was sampling done until redundancy in data was reached? **y**/n
7. Was informed consent obtained? **y**/n
8. Was data collection description clear and complete? **y**/n
9. Was the role of the researcher and relationship with participants described? **y**/n
10. Were the assumptions and biases of the researcher identified? **y**/n
11. Was procedural rigor used in data collection strategies? **y**/n
12. Were data analyses inductive? **y**/n
13. Were the findings consistent with and reflective of data? **y**/n
14. Was a decision trail developed? **y**/n
15. Was the process of analyzing the data described adequately? **y**/n
16. Did a meaningful picture of the phenomenon under study emerge? **y**/n
17. Was there evidence of all four components of trustworthiness? **y**/n
    a. Was the study credible?
    b. Was the study transferable?
    c. Was the study dependable?
    d. Was the study confirmable?
18. Were the conclusions appropriate given the study findings? **y**/n
19. **Did the findings contribute to theory development and future OT/School-based practice?** **y**/n

TOTAL Yes: ___/19

Inclusion/Exclusion
Include in the study if **at least 50% or ≥ 10** questions answered yes **INCLUDE** ☐
Exclude from the study **if ≤ 9** questions answered yes

GRADE SYSTEM: Qualitative Sources, *Continued*

URDC EVALUATION TOOL

Study Utility Score (U)
1 point if considered to have high utility to OT/School-Based Practice
0 point if considered to have low utility to OT/School-Based Practice

TOTAL U Score: ____/1

Study Relevancy Score (R)
1 point if considered high relevance to the Integrative Review
0 point if considered low relevance to the Integrative Review

TOTAL R Score: ____/1

Study Design/Content Score (D/C)
1 point if at least 75% or if ≥15 questions were answered "yes"
0 point if 50%- 74% or 10- 14 questions were answered "yes"

TOTAL D/C Score: ____/1

FINAL GRADE:____ /3

APPENDIX K GRADE SYSTEM: MIXED METHOD SOURCES

PUBLICATION QUESTIONNAIRE: MIXED METHOD SOURCES

Based on Critical Review Forms, Quantitative Studies (Law, et al., 1998) and Qualitative Studies (Letts, et al., 2007)

Title:

Author:

1.	Was the purpose/research question stated clearly?	**y**/n
2.	Was relevant background literature reviewed?	**y**/n
3.	Was the study design described?	**y**/n
4.	Was a theoretical perspective identified?	**y**/n
5.	Was the design appropriate for the study?	**y**/n
6.	Were biases to the study design avoided?	**y**/n
7.	Was the sample described in detail?	**y**/n
8.	Was the sample size justified or purposeful selection described?	**y**/n
9.	Was informed consent obtained?	**y**/n
10.	Was the frequency of the outcome measurement reported?	**y**/n
11.	Were the outcome measures reliable?	**y**/n
12.	Were the outcome measures valid?	**y**/n
13.	Was the intervention described in detail?	**y**/n
14.	**Could the intervention be replicated in OT/School-based practice**	**y**/n
15.	Was contamination avoided?	**y**/n
16.	Was co-intervention avoided?	**y**/n
17.	Was the data collection description clear and complete?	**y**/n
18.	Was the role of the researcher and relationship with participants described?	**y**/n
19.	Were the assumptions and biases of the researcher identified?	**y**/n
20.	Was procedural rigor used in data collection strategies?	**y**/n
21.	Were data analyses inductive?	**y**/n
22.	Was a decision trail developed?	**y**/n
23.	Was the process of analyzing the data described adequately?	**y**/n
24.	Did a meaningful picture of the phenomenon under study emerge?	**y**/n
25.	Was the study credible, transferable, dependable & confirmable?	**y**/n
26.	**Would the findings contribute to theory development in OT/ School-Based practice?**	**y**/n
27.	Were the results reported in terms of statistical significance?	**y**/n
28.	Were drop-outs reported?	**y**/n
29.	Were conclusions appropriate given study methods, results/findings?	**y**/n
30.	Was clinical importance reported?	**y**/n
31.	Were the main limitations in the study reported?	**y**/n
32.	**Were the implications for OT/School-based practice reported?**	**y**/n
	TOTAL Yes: ___/32	

Inclusion/Exclusion

Include in the study if **at least 50% or ≥ 16** questions answered yes **INCLUDE** ☐

Exclude from the study **if ≤ 15** questions answered yes

GRADE SYSTEM: Mixed Method Sources, *Continue*

URDC EVALUATION TOOL

Study Utility Score (U)
1 point if considered to have high Utility to OT/School-Based practice
0 point if considered to have low Utility to OT/ School-based practice

TOTAL U Score: ____/1

Study Relevancy Score (R)
1 point if considered high relevance to the Integrative Review
0 point if considered low relevance to the Integrative Review

TOTAL R Score: ____/1

Study Design/Content Score (D/C)
1 point if at least 75% or if ≥ 24 questions were answered "yes"
0 point if 50% -74% or 16-23 questions were answered "yes"

TOTAL D/C Score: ____/1

FINAL GRADE:____ /3

APPENDIX L GRADE SYSTEM: ALTERNATIVE SOURCES

PUBLICATION QUESTIONNAIRE: ALTERNATIVE SOURCES
Based on Critically Analyzing Information Sources (Cornel University Library, retrieved November 17, 2010)

Title:
Author:

1. Is the published work substantiated by the author(s) credentials (institutional affiliation, educational background, past writing, experience) **y**/n
2. Is the author associated with a reputable institution or organization? **y**/n
3. Considering the inclusion/exclusion limits, is the publication date of this source considered current given the topic. (i.e. if topic is on theory, older publication date is considered appropriate, however if the topic is on science/humanities, recent publications or revised editions within the past five years are considered more appropriate) **y**/n
4. Is the source, technical or advanced or specialized for your needs? **y**/n
5. Is the purpose of this source described coherently? **y**/n
6. Is relevant literature or background information provided? **y**/n
7. Does the information appear to be valid or well-researched? **y**/n
8. Are the ideas, arguments or information more or less in line with other pieces of information you have read (if the ideas, arguments or information are radically different, does the author at least identify the difference and justify reasoning for new beliefs?) **y**/n
9. Is the author's point of view objective or impartial? **y**/n
10. Is the publication organized logically? **y**/n
11. Are the main points presented clearly? **y**/n
12. Does the author refer to an effective amount of other sources to substantiate ideas, arguments or information? **y**/n
13. Is there application to OT/School-based practice or early Education? **y**/n
14. **Is there application to occupational justice, or handwriting practices?** **y**/n

TOTAL Yes: ___/14

Inclusion/Exclusion
Include in the study if **at least 50% or ≥ 7** questions answered yes **INCLUDE** ☐
Exclude from the study **if ≤ 6** questions answered yes

GRADE SYSTEM: Alternative Sources, *Continue*

URDC EVALUATION TOOL

Study Utility Score (U)
1 point if considered to have high utility to OT/School-Based Practice
0 point if considered to have low utility to OT/School-Based Practice

TOTAL U Score: ____/1

Study Relevancy Score (R)
1 point if considered high relevance to the Integrative Review
0 point if considered low relevance to the Integrative Review

TOTAL R Score: ____/1

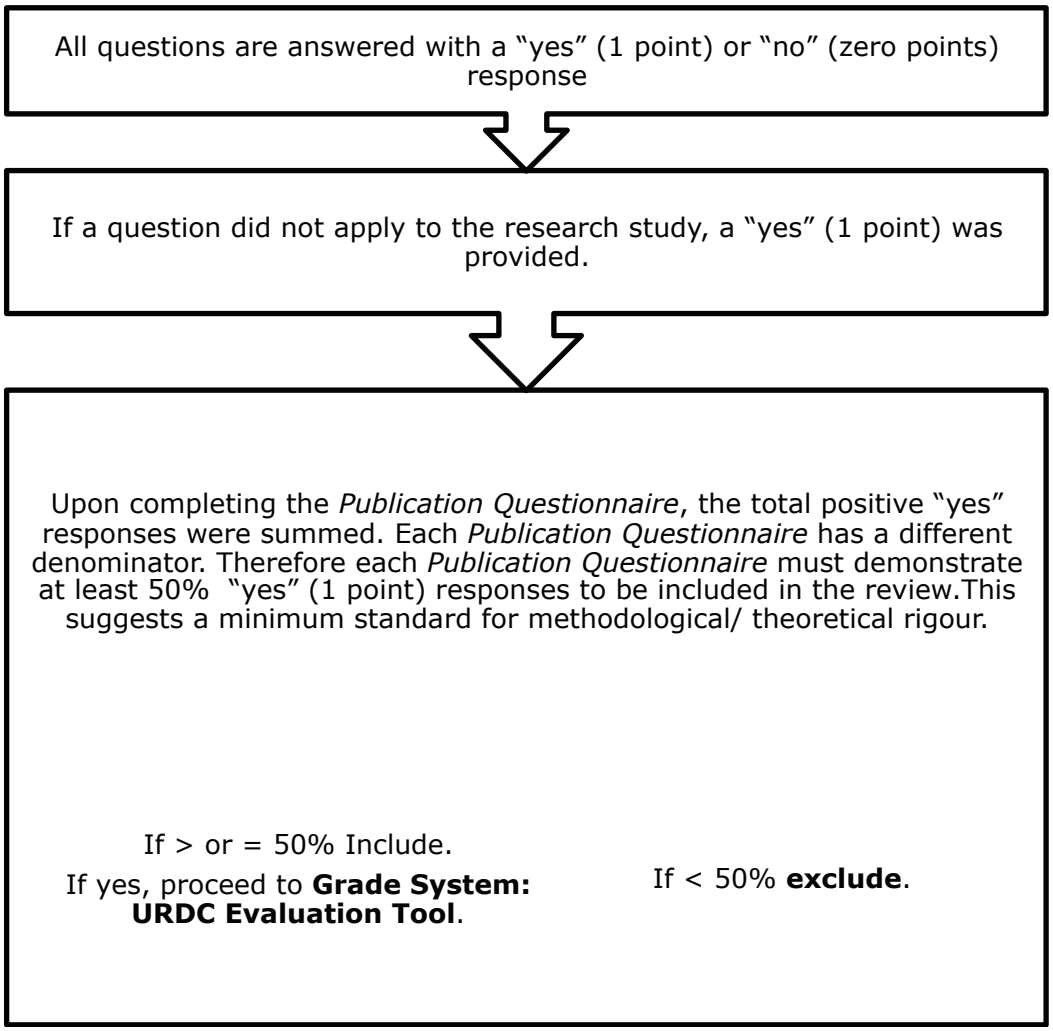
Study Design/Content Score (D/C)
1 point if at least 75% or if ≥11 questions were answered "yes"
0 point if 50% -74% or 7-10 questions were answered "yes"

TOTAL D/C Score: ____/1

FINAL GRADE:____ /3

APPENDIX M DECISION TREE: GRADE SYSTEM

GRADE SYSTEM: PUBLICATION QUESTIONNAIRE



DECISION TREE: GRADE SYSTEM *Continue*

Grade System: URDC Evaluation Tool

Utility*: A literature source is described as "utilizable" if a wide group of Occupational Therapists or Teachers in primary education, may use the information to some extent (either be influenced by or implement a specific process, intervention, etc).*

High Utility (1 point awarded) Low Utility (0 points awarded)

For Example: A literature source may have concluded that taking a particular type of medication for ADHD results in increased written output quality- this would be considered to have low utility because it is unrealistic for an occupational therapist or teacher to recommend this intervention. Alternatively, if the literature source concluded that writing with small, golf-sized pencils improved grasp- this intervention would be easily implemented in the schools and therefore would be considered to have high utility (1 point awarded). Proceed to **Relevance**

Relevance*: A literature source is described as relevant if it has a direct connection or significance to the objective of the integrative review: occupational justice and or handwriting practices.*

High Relevance (1 point awarded) Low Relevance (0 points awarded)

Subjective judgments on how relevant the source is, will be made. To increase rigour, this process is guided by the use of the Framework of Occupational Justice. If the literature source could be viewed as a Structural or Contextual factor of the Framework of Occupational Justice or regarding handwriting practices, it would be considered to have high relevance. (1 point awarded).

Proceed to **Design/Content**

Design/Content*- A literature source is described in terms of the study design/content score.*

High Design Rigour (1 point awarded) Low Design Rigour (0 points awarded)

High Content Analysis (1 point awarded) Low Content Analysis (0 points awarded)

The URDC Evaluation Tool incorporates and converts the raw scores from the Publication Questionnaire into a standard score.

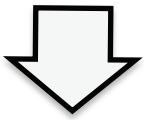
High Design/Content Rigour (Publication Questionnaire percentage of 100%-75%)
Low Design/Content Rigour (Publication Questionnaire percentage of 50%-74%)

Proceed to Final Grade

DECISION TREE: GRADE SYSTEM *Continue*

GRADE SYSTEM: FINAL GRADE

Combining the Utility, Relevancy and Design/Content Scores represents the Final Grade. These scores are classified as:



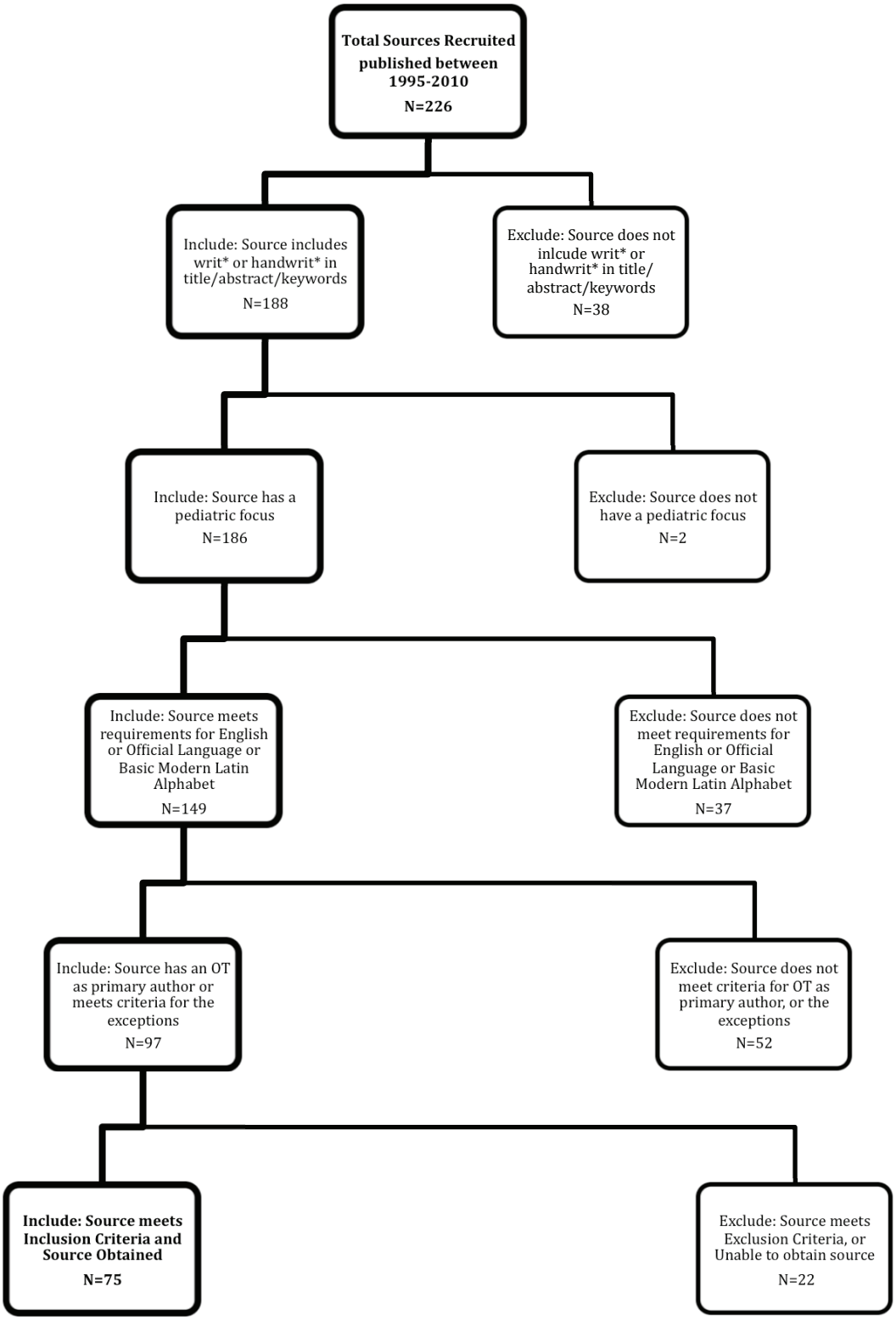
3/3 = ***Highly Significant*** to the integrative review

2/3 = *Medium Significance* to the integrative review

1/3 = *Low Significance* to the integrative review
(**EXCLUDE** if the only point is given for Design/Content Score.)

0/3 = *No Significance* to the integrative review-
(EXCLUDE from the review)

APPENDIX N FLOW CHART



APPENDIX O AUTHOR LIST OF INCLUDED SOURCES

Addy, L. (1996).
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Asher, A. V. (2006).
Banks, R., Rodger, S., & Polatajko, H. J. (2008).
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Cornhill, H., & Case-Smith, J. (1996).
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Daly, C. J., Kelley, G. T., & Krauss, A. (2003).
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DuBois, L., Klemm, A., Murchland, S., & Ozols, A. (2004).
Duff, S., & Goyen, T. A. (2010).
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Oehler, E., DeKrey, H., Eadry, E., Fogo, J., Lewis, E., Maher, C., & Schilling, A. (2000).
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APPENDIX P FACTOR TYPES & SOURCES

FACTOR TYPES	SOURCES
Structural Factors: Occupational Determinants	N/A
Structural Factors: Occupational Forms	1. Bayona, C., McDougal, J., Tucker, M.A., Nichols, M., & Mandich, A. (2006). 2. Chu, S. (1997). 3. Diekema, Deitz & Amundson (1997) 4. Erhardt, R. & Meade, V. (2005). 5. Freeman, A. R., MacKinnon, J. R., & Miller, L. T. (2004). 6. Daniel, M. E., & Froude, E. H. (1998). 7. Hammerschmidt, S. L., & Sudsawad, P. (2004). 8. Handley-More, D., Deitz, J., Billingsley, F. F., & Coggins, T. E. (2003). 9. Lederer, J. (2004). 10. McGarrigle, J., & Nelson, A. (2006). 11. Missiuna, C., Pollock, N., Egan, M., Delaat, D., Gaines, R., Soucie, H. (2008). 12. Peterson, C. Q., & Nelson, D. L. (2003). 13. Rogers, J., & Case-Smith, J. (2002). 14. Schwellnus, H., Boschen, K., Law, M., & Young, N. (2009).
Contextual Factors	1. Addy, L. (1996). 2. Banks, R., Rodger, S., & Polatajko, H. J. (2008). 3. DuBois, L., Klemm, A., Murchland, S., & Ozols, A. (2004). 4. Feder, K. P., Majnemer, A., Bourbonnais, D., Platt, R., Blayney, M., & Synnes, A. (2005). 5. Handley-More, D., Deitz, J., Billingsley, F. F., & Coggins, T. E. (2003). 6. Malloy-Miller, T., Polatajko, H., & Anstett, B. (1995). 7. McGarrigle, J., & Nelson, A. (2006). 8. Miller, L. T., Missiuna, C. A., Macnab, J. J., Malloy-Miller, T., & Polatajko, H. J. (2001). 9. Missiuna, C. (1999) 10. Missiuna, C. (2002). 11. Missiuna, C., Pollock, N., Egan, M., Delaat, D., Gaines, R., Soucie, H. (2008). 12. Missiuna, C., Rivard, L., & Pollock, N. (2004). 13. Peterson, C. Q., & Nelson, D. L. (2003). 14. Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J. (2003). 15. Tam, C., Ryan, S. E., Rigby, P., & Sophianopoulos, M. (2009).
Occupation Factors	All
Interactions of the Occupation	All

APPENDIX Q LITERATURE CHARTS

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
A perceptuo-motor approach to handwriting	Addy, L. M.	*British Journal of Occupation al Therapy,* 59(9), 427-432, 1996.	1. Investigate the effect of using the Teodorescu handwriting program on the three groups of children 2. Investigate if the program is a feasible educational resource to use.	Mixed Methods	230	2	yes
The occupational therapy approach to handwriting.	Addy, L.	*Therapy Weekly, 30* (18), 12-15, 2003.	1. Describe a kinaesthetic approach to handwriting using the handwriting program Speed Up!	Alternative	n/a	3	n/a
Handwriting instruction in elementary schools.	Asher, A. V.	*American Journal of Occupation al Therapy, 60*(4), 461-471, 2006.	1. Describe HW in the school systems from a teachers perspective K-Gr 6.	Quantitative	47	3	yes
Mastering handwriting: How children with developmental coordination disorder succeed with CO-OP.	Banks, R., Rodger, S., & Polatajko, H. J.	*OTJR: Occupation , Participatio n & Health, 28*(3), 100-109, 2008	1. Describe the cognitive strategies used by children with DCD during CO-OP intervention for handwriting	Quantitative	4	3	yes
School-based occupational therapy for children with fine motor difficulties: Evaluation functional outcomes and fidelity of services.	Bayona, C., McDougal, J., Tucker, M.A., Nichols, M., & Mandich, A.	*Physical & Occupation al Therapy in Pediatrics, 26*(3), 89-110, 2006	1. Investigate the utility of occupational therapy services with fine motor challenges 2. Evaluate service delivery	Quantitative	83	3	yes
Grip form and graphomotor control in preschool children.	Burton, A. W., & Dancisak, M. J.	*American Journal of Occupation al Therapy, 54*(1), 9-19, 2000	1. Identify the utility of Schneck & Henderson's Grip Coding (both 10pt & 5pt Scale). 2. Identify the impact of grip patterns on accuracy of HW 3. Identify the impact of diameter on grip forms	Quantitative	60	3	no
Where does handwriting fit in? Strategies to support academic achievement.	Cahill, S. M.	*Interventio n in School and Clinic, 44*(4), 223-228, 2009.	1. Review the current strategies for HW intervention and instruction	Alternative	n/a	3	n/a
Teaching handwriting in kindergarten.	Carlson, C.	*OT Practice, September*, 13-19, 2009.	1. Investigate the impacts of adapting a handwriting program for kindergarten children	Quantitative	Not repor ted	2	no

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Effectiveness of school-based occupational therapy intervention on handwriting.	Case-Smith, J.	*American Journal of Occupational Therapy, 56*(1), 17-25, 2002.	1. Examine the impact of OT intervention on HW legibility/speed and VMI, VP, In-hand manipulation & dexterity.	Quantitative	38	3	yes
A novel instrument for quantifying grip activity during handwriting.	Chau, T., Ji, J., Tam, C., & Schwellnus, H.	*Archives of Physical Medicine & Rehabilitation, 87*(11), 1542-1547, 2006.	1. Describe and show how a tool can be made from everyday parts, while investigating the differences between grip and normal forces of able-bodied and children with CP	Quantitative	12	3	yes
Occupational therapy for children with handwriting difficulties: A framework for evaluation and treatment.	Chu, S.	*British Journal of Occupational Therapy, 60*(12), 514-520, 1997.	1. Describe the role of OT in HW using a Conceptual Model for Performance in Handwriting	Alternative	n/a	3	n/a
Improving students' handwriting.	Clark-Wentz, J.	*OT Practice, 2*(10), 29-33, 1997.	1. Describe the role of OT in HW	Alternative	n/a	3	n/a
Factors that relate to good and poor handwriting.	Cornhill, H., & Case-Smith, J.	*American Journal of Occupational Therapy, 50*(9), 732-739, 1996.	1. Identify differences in Eye-Hand Coordination, Visuomotor Integration & In-hand manipulation between children with good and poor HW using the MHT and teacher report. 2. Identify if the performance component can predict handwriting performance (MHT)	Quantitative	48	2	yes
Relationship between visual-motor integration and handwriting skills of children in kindergarten: A modified replication study.	Daly, C. J., Kelley, G. T., & Krauss, A.	*American Journal of Occupational Therapy, 57*(4), 459-462, 2003.	1. Investigate the relationship between visual motor integration and HW skills in kindergarten students. 2. Investigate the impact of lined vs. unlined paper on the quality of HW.	Quantitative	54	3	yes
Reliability of occupational therapist and teacher evaluations of the handwriting quality of grade 5 and 6 primary school children.	Daniel, M. E., & Froude, E. H.	*Australian Occupational Therapy Journal, 45*(2), 48-58, 1998.	1. Evaluate the reliability of Ots & Teacher's ability to assess HW Quality. 2.Identify the components of Quality HW	Quantitative	61	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Pencil grasp and children's handwriting legibility during different-length writing tasks.	Dennis, J. L., & Swinth, Y.	*American Journal of Occupation al Therapy, 55*(2), 175-183, 2001.	1. Investigate the impact of pencil grasp on quality of legibility during long and short writing tasks.	Quantitative	46	3	yes
The effects of sensorimotor-based intervention versus therapeutic practice on improving handwriting performance in 6- to 11-year-old children	Denton, P. L., Cope, S., & Moser, C.	*American Journal of Occupation al Therapy, 60*(1), 16-27, 2006.	1. Investigate the impact of treatment type to HW performance 2. Investigate the impact of treatment type to sensorimotor skills	Quantitative	38	1	yes
Test-retest reliability of the evaluation tool of children's handwriting-manuscript	Diekema, S. M., Deitz, J., & Amundson, S. J.	*American Journal of Occupation al Therapy*, 52(4), 248-255, 1998.	1. Examine the test-retest reliability of legibility scores on the ETCH	Psychometric Analysis	31	3	yes
Handwriting of children who have hemiplegia: A profile of abilities in children aged 8-13 years from a parent and teacher survey	DuBois, L., Klemm, A., Murchland, S., & Ozols, A.	*Australian Occupation al Therapy Journal, 51*(2), 89-98, 2004.	1. Investigate the extent and details to which children with Hemiplegia experience HW problems.	Quantitative	57	3	yes
Reliability and validity of the evaluation tool of children's handwriting-cursive (ETCH-C) using the general scoring criteria	Duff, S., & Goyen, T. A.	*American Journal of Occupation al Therapy, 64*(1), 37-46, 2010.	1. Determine the reliability and validity of the ETCH-Cursive using the Script writing style.	Psychometric Analysis	63	3	yes
Improving handwriting without teaching handwriting: The consultative clinical reasoning process	Erhardt, R. & Meade, V.	*Australian Occupation al Therapy Journal*, 52, 199-210, 2005.	1. Describes an collaborative clinical reasoning process for handwriting intervention	Alternative	n/a	3	n/a
Handwriting: Current trends in occupational therapy practice	Feder, K., Majnemer, A., & Synnes, A.	*Canadian Journal of Occupation al Therapy, 67*(3), 197-204, 2000.	1. Determine Canadian OT's assessment, treatments used for HW challenges. 2. Determine the use of weights as a treatment modality for HW	Quantitative	50	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Handwriting performance in preterm children compared with term peers at age 6 to 7 years	Feder, K. P., Majnemer, A., Bourbonnais, D., Platt, R., Blayney, M., & Synnes, A.	*Developmental Medicine & Child Neurology, 47*(3), 163-170, 2005.	1. Investigate HW performance in preterm children in gr. 1 compared to their peers. 2.Investigate HW performance and physical performance components 3. Investigate HW performance and psychosocial performance components	Quantitative	107	3	no
Handwriting performance on the ETCH-M of students in a grade one regular education program	Feder, K. P., Majnemer, A., Bourbonnais, D., Blayney, M., & Morin, I.	*Physical & Occupational Therapy in Pediatrics, 27*(2), 43-62, 2007.	1. Identify the performance of regular education program grade one children. 2.Identify any gender differences, 3. Identify if performance components are causal/ correlational to HW performance 4. Identify the teacher's ability to rate students compared to ETCH scores	Quantitative	69	3	no
Assistive technology and handwriting problems: What do occupational therapists recommend?	Freeman, A. R., MacKinnon, J. R., & Miller, L. T.	*Canadian Journal of Occupational Therapy, 71*(3), 150-160, 2004.	1. Identify the types of technology OTs recommend for students with HW problems 2. Identify factors impacting decisions	Quantitative	443	3	yes
Discriminant validity of the developmental test of visual-motor integration in relation to children with handwriting dysfunction.	Goyen, T., & Duff, S.	*Australian Occupational Therapy Journal, 52*(2), 109-115, 2005.	1. Identify the discriminant validity of the VMI and the relationship to HW Problems in older children	Quantitative	70	3	yes
Teachers' survey on problems with handwriting: Referral, evaluation, and outcomes.	Hammerschmidt, S. L., & Sudsawad, P.	*The American Journal of Occupational Therapy, 58*(2), 185-192, 2004.	1. Investigate the factors teachers identify as a problem in HW leading to a referral to school based OTs. 2. Identify the criteria teachers used to evaluate HW 3. Investigate what are the types of HW outcomes teachers expect	Quantitative	314	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Facilitating written work using computer word processing and word prediction	Handley-More, D., Deitz, J., Billingsley, F. F., & Coggins, T. E.	*American Journal of Occupational Therapy, 57*(2), 139-151, 2003.	1. Investigate if written communication improved (in children with HW difficulties) when using word processing, or word processing with prediction or just handwriting 2. Investigate if written communication; legibility, spelling, quantity and rate are better with HW, word processing or word prediction	Quantitative	3	2*	yes
Implications for occupational therapists from an occupation-centered perspective	Jewell, K.H.	*OT Practice 4*(8), 32-36, 1999.	1. Describe the role of the occupational therapists using an occupation-centered perspective and handwriting. 2. Describe the process of handwriting	Alternative	n/a	3	n/a
Handwriting in the schools: Challenges and solutions.	Judkins, J., Dague, H., & Cope, S.	*Early Intervention & School Special Interest Section Quarterly, 16*(1), 1-4, 2009.	1. Discusses Occupational Therapy interventions for handwriting and the challenges and solutions related to treating students with handwriting problems	Alternative	n/a	3	n/a
Handwriting consultation in elementary schools.	Kiss, D. M.	*OT Practice 12*(14), 11-14, 2007.	1. Describe the role of occupational therapists in the school system 2. Describe the pilot, a consultative approach to handwriting	Quantitative	Not reported	2	no
A validity study of the evaluation tool of children's handwriting-cursive.	Koziatek, S. M., & Powell, N. J.	*American Journal of Occupational Therapy,* 56(4), 446-453, 2002.	1. Establish concurrent validity of the ETCH-C with Cursive Practice and Review and the cursive handwriting grades assigned by teachers. 2. Identify the legibility percentage score discriminating between satisfactory and unsatisfactory handwriting.	Psychometric Analysis	101	3	no
Pencil grips, legibility, and speed of fourth-graders, writing in cursive	Koziatek, S. M., & Powell, N. J.	*American Journal of Occupational Therapy, 57*(3), 284-288, 2003.	1. Investigate the relationship between pencil grip pattern, legibility and speed.	Quantitative	101	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Evidence for occupational therapy interventions: A student educational assignment.	Lederer, J. M.	*Occupational Therapy in Health Care, 18*(4), 29-40, 2004.	1. Describe a graduate student assignment on researching evidenced based occupational therapy interventions	Alternative	n/a	2	n/a
The log handwriting program improved children's writing legibility: A pretest-posttest study.	Mackay, N., McCluskey, A., & Mayes, R.	*American Journal of Occupational Therapy, 64*(1), 30-36, 2010.	1. Determine the feasibility and the handwriting performance improvement as a result of using the Log Handwriting Program.	Quantitative	16	3	yes
Handwriting error patterns of children with mild motor difficulties.	Malloy-Miller, T., Polatajko, H., & Anstett, B.	*Canadian Journal of Occupational Therapy, 62*(5), 258-267, 1995.	1. Identify handwriting errors patterns 2. Determine if these are associated with perceptual-motor abilities, and if age was impacted results.	Quantitative	66	3	yes
Handwriting readiness: locatives and visuomotor skills in the kindergarten year.	Marr, D., Windsor, M., & Cermak, S.	*Early Childhood Research & Practice.* Retrieved 2010, November 15 from http://ecrp.uluc.edu/v3n1/marr.html., 2001.	1. Investigate the relationship between cognitive understanding of spatial/temporal locatives, and graphomotor; HW production.	Quantitative	138	3	yes
Consistency of handwriting in early elementary students.	Marr, D., & Cermak, S.	*American Journal of Occupational Therapy, 57*(2), 161-167, 2003.	1. Examine the consistency of HW in children from K-Gr 1.	Quantitative	93	3	yes
Consistency of handwriting performance across the early elementary grades.	Marr, D.	*OTJR: Occupation, Participation & Health, 25*(4), 143-148, 2005.	1. Identify the consistency of HW performance from K to Gr 3.	Quantitative	89	3	yes
Outcomes associated with a summer handwriting course for elementary students.	Marr, D., & Dimeo, S. B.	*American Journal of Occupational Therapy, 60*(1), 10-15, 2006.	1. Identify the impact of summer hw course on HW outcomes	Quantitative	26	3	yes
Evaluating a school skills programme for Australian indigenous children: A pilot study.	McGarrigle, J., & Nelson, A.	*Occupational Therapy International, 13*(1), 1-20, 2006.	1. Determine if there improvements in HW after using the schools skills program. 2. To determine if there are greater skills improvement in the experimental groups HW	Quantitative	13	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Occupational therapy school services improved children's writing skills but did not adhere to the consultation model.	McGibbon Lammi, B.	*Occupational Therapy Now, 10*(2), 26-28, 2008.	1. Critically appraise the article by Bayona et al., 2006.	Alternative	n/a	3	n/a
Clinical description of children with developmental coordination disorder.	Miller, L. T., Missiuna, C. A., Macnab, J. J., Malloy-Miller, T., & Polatajko, H. J.	*Canadian Journal of Occupational Therapy, 68*(1), 5-15, 2001.	1. Describe typical reasons for referral, co-morbidity information, assessment practices, occupational performance issues identified in children who may have DCD	Quantitative	556	2	yes
Keeping current in… Children with fine motor difficulties.	Missiuna, C.	Can Child, McMaster University: Keeping Current # 99-3, 1999.	1. Describe children with 'fine motor' problems, particularly DCD	Alternative	n/a	2	n/a
Poor handwriting is only a symptom: Children with developmental coordination disorder	Missiuna, C.	*Occupational Therapy Now, 4*(5), 4-6, 2002.	1. Describe DCD and the role of occupational therapy with children diagnosed with DCD	Alternative	n/a	3	n/a
They're bright but can't write: Developmental coordination disorder in school aged children	Missiuna, C., Rivard, L., & Pollock, N.	*TEACHING Exceptional Children Plus: 1(*1). Retrieved 2010, November 15, from http://escholarship.bc.edu/education/tecplus/vol1/iss1/3 2004.	1. Describe children with DCD and the handwriting problems and possible interventions	Alternative	n/a	3	n/a
Enabling occupation through facilitating the diagnosis of developmental coordination disorder.	Missiuna, C., Pollock, N., Egan, M., Delaat, D., Gaines, R., Soucie, H.	*Canadian Journal of Occupational Therapy, 75*(1), 26-34, 2008	1. Describe the role of occupational therapists in identifying DCD and facilitating a diagnosis of DCD	Alternative	n/a	2	n/a
The effect of pencil size and shape on the pre-writing skills of kindergartners.	Oehler, E., DeKrey, H., Eadry, E., Fogo, J., Lewis, E., Maher, C., & Schilling, A.	*Physical & Occupational Therapy in Pediatrics, 19*(3), 53-60, 2000.	1. Identify if a difference exist in pre-writing skills of Kindergarten aged children, when using a different: sized pencil and shape of pencil. 1b. Identify the grasp type used.	Quantitative	126	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Handwriting Assessment Protocol-2nd edition	Pollock, N., Lockhart, J., Blowes, B., Semple, K., Webster, M., Farhat, L., Jacobson, J., Bradley, J., & Brunetti, S.	*CanChild Centre for Childhood Disability Research,* McMaster University; 2009.	1. Describe a handwriting assessment protocol	Alternative	n/a	3	n/a
Effect of an occupational intervention on printing in children with economic disadvantages.	Peterson, C. Q., & Nelson, D. L.	*American Journal of Occupation al Therapy, 57*(2), 152-160, 2003.	1. Evaluate whether OT intervention for HW was more beneficial than no intervention.	Quantitative	59	3	yes
Occupational therapy decision making guidelines for problems in written productivity.	Rigby, P., & Schwellnus, H.	*Physical & Occupation al Therapy in Pediatrics,* 19(1), 5-27, 1999.	1. Describe a literature review conducted on HW 2. Survey OTs to obtain information about their analysis of assessment and selection of interventions for children diagnosed with CP.	Quantitative	26	1	yes
Effects of a kinesthetic cursive handwriting intervention for grade 4-6 students	Roberts, G., & Siever, J., & Mair, J.	*American Journal of Occupation al Therapy,* 64(5), 745-755, 2010.	1. Investigate the impacts of Loops and Other Groups (kinesthetic writing program) on cursive legibility, speed and personal satisfaction	Quantitative	18	3	yes
Relationships between handwriting and keyboarding performance of sixth-grade students	Rogers, J., & Case-Smith, J.	*American Journal of Occupation al Therapy, 56*(1), 34-39, 2002.	1. Investigate the relationship between handwriting and keyboarding	Quantitative	38	3	yes
Pre-writing skills for children under five.	Saunders, D.	*Canadian Association of Occupation al Therapists*-Quick Tips. Retrieved from: http://www.caot.ca/default.asp?pageID=3711., 2010	1. Describe pre-writing skills and how to develop these skills	Alternative	n/a	3	n/a
Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versus chairs.	Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J.	*American Journal of Occupation al Therapy, 57*(5), 534-541, 2003.	1. Investigate if seating (therapy ball) will improve in-seat behaviors and production of legible words.	Quantitative	3	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Clinical interpretation of "Test-retest reliability of the evaluation tool of children's handwriting-manuscript"	Schneck, C. M.	*American Journal of Occupational Therapy, 52*(4), 256-258, 1998.	1. Provide a clinical interpretation of the study by Diekema et al., 1998.	Alternative	n/a	2	n/a
The development of the tool for optimizing written productivity (TOW-P).	Schwellnus, H., & Lockhart, J.	*Physical & Occupational Therapy in Pediatrics, 22*(3-4), 5-22, 2002.	1. Investigate the methodology of the TOW-P 2. Determine the frequency of intervention for HW challenges	Quantitative	85	1	yes
The clinical utility of a tool for optimising written productivity	Schwellnus, H., Boschen, K., Law, M., & Young, N.	*British Journal of Occupational Therapy, 72*(5), 205-211, 2009.	1. Determine if clinicians found the TOW-P clinically useful.	Quantitative	13	3	yes
Comparison of cursive handwriting instruction programs among students without identified problems	Shimel, K., Candler, C., & Neville-Smith, M.	*Physical & Occupational Therapy in Pediatrics, 29*(2), 172-183, 2009.	1. Compare cursive writing programs: HWT, Loops & Other Groups & Zaner Bloser.	Quantitative	50	3	yes
The relationship between the evaluation tool of children's handwriting and teachers' perceptions of handwriting legibility	Sudsawad, P., Trombly, C. A., Henderson, A., & Tickle-Degnen, L.	*American Journal of Occupational Therapy, 55*(5), 518-523, 2001.	1. Determine the Ecological validity of the ETCH to teacher's perceptions of HW legibility	Quantitative	45	3	yes
Testing the effect of kinesthetic training on handwriting performance in first-grade students	Sudsawad, P., Trombly, C. A., Henderson, A., & Tickle-Degnen, L.	*American Journal of Occupational Therapy, 56*(1), 26-33, 2002.	1. Investigate if kinesthetic training would lead to improvement in HW quality and speed.	Quantitative	45	2	yes
Joint laxity in the index finger and thumb and its relationship to pencil grasps used by children.	Summers, J.	*Australian Occupational Therapy Journal, 48*(3), 132-141, 2001.	1. Determine the association between joint laxity and pencil grasp used.	Quantitative	55	3	yes
Rater reliability of the adapted scoring criteria of the Minnesota Handwriting Assessment for children with cerebral palsy	Tam, C., Ryan, S. E., Rigby, P., & Sophianopoulos, M.	*Australian Occupational Therapy Journal, 56*(6), 403-408, 2009.	1.Describe guidelines for the MHA-CP scoring criteria, 2. Investigate the inter & intra rater reliability for the MHA-CP.	Psychometric Analysis	30	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Teaching teachers to teach handwriting	Vreeland, E.	*OT Week, (March),* 8-9, 1999.	1. Describe the process of OTs developing inservices for teachers on handwriting and one OTs experience with developing a school-district's curriculum guide for handwriting	Alternative	n/a	3	n/a
Interrater reliability of the handwriting speed test.	Wallen, M., Bonney, M., & Lennox, L.	*Occupational Therapy Journal of Research, 17*(4), 280-287, 1996.	1. Determine inter-rater reliability of the Handwriting Speed Test (HST)	Psychometric Analysis	165	3	yes
Critically appraised papers. Therapeutic practice resulted in moderate improvement in handwriting ability for children with poor handwriting when compared with sensorimotor intervention, but not when compared with a control group	Wallen, M., & Froude, E.	*Australian Occupational Therapy Journal, 54*(3), 239-240, 2007.	1. Critically appraise the article by Denton et al., 2006	Alternative	n/a	3	n/a
Critically appraised papers. kinaesthetic training was no more effective than handwriting practice or no treatment in improving kinaesthesis or handwriting speed and legibility in grade-one students.	Wallen, M., Goyen, T., & Duff, S.	*Australian Occupational Therapy Journal, 54*(3), 240-242, 2007.	1. Critically appraise the article by Sudsawad et al., 2002	Alternative	n/a	3	n/a
Test-retest, interrater, and intrarater reliability, and construct validity of the handwriting speed test in year 3 and year 6 students.	Wallen, M., & Mackay, S.	*Physical & Occupational Therapy in Pediatrics, 19*(1), 29-42, 1999.	1. Re-eximine interrater reliability and 2. Establish intrarater reliability and test-retest. 2. Establish Construct Validity	Psychometric Analysis	212	3	yes
The contribution of gender, orthographic, finger function, and visual-motor processes to the prediction of handwriting status	Weintraub, N., & Graham, S.	*Occupational Therapy Journal of Research, 20*(2), 121-140, 2000.	1. Identify the processes of handwriting, specifically, to determine if orthographic, finger function, visual motor integration and gender are good predictors of children's handwriting status	Quantitative	56	3	yes

Title	Author	Journal, vol(n), p. yr.	Purpose	Design	Sub-jects N=	Final Grade N/3	Limitat-ions Report-ed
Clinical interpretation of "Grip form and graphomotor control in preschool children".	Windsor, M.	*American Journal of Occupational Therapy, 54*(1), 18-19, 2000.	1. Clinical interpretation of the research study by Burton and Dancisak, 2000.	Alternative	n/a	3	n/a
Multisensory approach to handwriting remediation: Perceptions of school-based occupational therapists.	Woodward, S., & Swinth, Y.	*American Journal of Occupational Therapy, 56*(3), 305-312, 2002.	1. Identify the most frequently used multisensory modalities used 2. Determine if there is a consensus among school based OTs regarding the sensory systems impacted in HW 3. Determine if there is a difference in the multisensory modalities used and the OT demographic information	Quantitative	198	3	yes
Comparisons among tools, surface orientation, and pencil grasp for children 23 months of age	Yakimishyn, J. E., & Magill-Evans, J.	*American Journal of Occupational Therapy, 56*(5), 564-572, 2002.	1. Determine the impact of the drawing tool and the drawing surface on grasp patterns of two year olds.	Quantitative	51	3	yes
Use of modern cursive handwriting and handwriting speed for children ages 7 to 14 years	Ziviani, J.	*Perceptual and Motor Skills, 82,* 282, 1996.	1. Identify the handwriting speeds of children using the modern cursive handwriting	Quantitative	172	2	no
Writing speed and legibility of 7-14-year-old school students using modern cursive script.	Ziviani, J., & Watson-Will, A.	*Australian Occupational Therapy Journal,* 45(2), 59-64, 1998.	1. Identify children's performance in handwriting (legibility and speed) using modern cursive script. 2. Compare findings to previous HW curriculum using ball and stick method	Quantitative	372	3	no
Cognitive versus multisensory approaches to handwriting intervention: A randomized controlled trial	Zwicker, J. G., & Hadwin, A. F.	*OTJR: Occupation, Participation & Health, 29*(1), 40-48, 2009.	1. Investigate the effectiveness of two intervention approaches (cognitive vs. multisensory) to a control group in first and second graders.	Quantitative	72	3	yes

*with reservation

APPENDIX R WESTERN & NORTHERN CANADIAN PROTOCOL

Western Canadian Protocol for Collaboration in Basic Education (2010 December 30), The common curriculum framework for English language arts kindergarten to grade 12 1998. Retrieved from the Western and Northern Canadian Protocol website: http://www.wncp.ca/english/subjectarea/english-language-arts/ccf.aspx

The Common Curriculum Framework for English Language Arts, Kindergarten to Grade 12, Western Canadian Protocol for Collaboration in Basic Education, 1998.

	Outcomes
Kindergarten	… "Recognize that print is organized from top to bottom and left to right"… pg 20; … "Demonstrate curiosity about and experiment with letters" pg 28 … "Form recognizable letters and use letters and directional arrow keys on the keyboard" pg 52. …"Recognize own name, capital letters, and periods" pg 56
Grade 1	…"Use syntactic, semantic, graphophonic, and pragmatic cues (such as differentiating between letters and words…) to construct and confirm meaning" pg 20 …"Strive for consistency in letter size and shape; print letters legibly from left to right horizontally, using lines on a page as a guide; explore and use the keyboard to produce text" pg 52
Grade 2	…"Form letters and words of consistent size and shape; print legibly using correct formation and spacing; explore and use the keyboard to compose and revise text" pg 52
Grade 3	…"Print and write legibly, developing a personal style; space words consistently on a line and page or on a electronic screen." Pg 52 …"Prepare neat and organized compositions, reports, and charts that engage the audience" pg 52
Grade 4	…"Write legibly, using a handwriting style that is consistent in alignment, shape, slant, and spacing and experiment with the use of templates and familiar software when composing and revising." Pg 53

APPENDIX S ATLANTIC CANADA

New Brunswick Department of Education (2010 December 30), Curriculum development kindergarten to grade four. Retrieved from New Brunswick Department of Education and Early Childhood Development website: http://www.gnb.ca/0000/anglophone-e.asp#cd

The Atlantic Canada English Language Arts Curriculum (K-3 841860) 1998 New Brunswick Department of Education Curriculum Development Branch

	Outcomes
Emergent (K-1)	"Understand that print carries a message" pg 104 " Use some conventions of written language: develop the concept of directionality (left to right; top to bottom), …begin to use spacing between words… understand that letters can be written in upper and lower case forms (but often tend to them indiscriminately) pg 108
Early (1- 2)	" Use some conventions of written language: use conventional spacing between words"
Transitional (3-4)	No handwriting outcomes documented.

APPENDIX T BRITISH COLUMBIA & YUKON

Ministry of Education, Province of British Columbia (2010 December 30), English language arts kindergarten to grade 7, Retrieved from Government of British Columbia, Ministry of Education website: http://www.bced.gov.bc.ca/irp/subject.php?lang=en&subject=English%20Language%20Arts

	Outcomes
Kindergarten	"Print most of the letters of the alphabet, own name and a few simple words" pg 18 Suggested Achievement Indicators "Demonstrate motor skills needed to print…print their own name and the names of some family members of friends… usually print from left to right and top to bottom… distinguish between letters and numbers and between letters and words… orally explain and recognize that words consist of a series of letters separated by a space (printing may show a space between word-like clusters)… print most letters recognizably (e.g. some letters may be poorly formed and/or reversed; may use upper and lowercase letters indiscriminately)" pg.18
Grade 1	"Use some features and conventions of language to express meaning in their writing and representing, including… legible printing from left to right of all uppercase and lowercase letters…appropriate spacing between letters and words." pg 24 Suggested Achievement Indicators "Incorporate directionality into writing (e.g. Left to right and line movement down a page)… copy words… print legibly and correctly form letters (e.g. strive for consistency in letter size and shape)… use uppercase and lowercase letters with some consistency… use spaces between words" pg 24
Grade 2	"Letters printed legibly, consistent in shape and size, with appropriate spacing between letters and words" pg 25 Suggested Achievement Indicators "Print legibly and correctly form letters…appropriately space written work…use margins and spacing appropriately" pg 25
Grade 3	"Legible print, and begin to show proper alignment, shape, and slant of cursive writing… spacing words and sentences consistently on a line and page" pg 26 Suggested Achievement Indicators "Print legibly and begin to show proper alignment, shape, and slant for cursive writing…appropriately space written work" pg 26
Grade 4	"Legible writing that demonstrates awareness of alignment, shape, and slant… spacing words and sentences consistently on a line and page" pg 29 Suggested Achievement Indicators "Produce legible handwriting using a style that demonstrates awareness of alignment, shape, and slant…appropriately space written work" pg. 29

APPENDIX U ALBERTA

Alberta Education (2010 December 30), Programs of study. English language arts, Retrieved from Government of Alberta, Education website: http://education.alberta.ca/teachers/programs/english/programs.aspx

	Outcomes
Kindergarten	"copy scribed words and print texts to assist with writing" p. 26. "form recognizable letters by hold a pen or pencil in an appropriate and comfortable manner" p.66 "print own name, and copy environmental print and words with personal significance" p. 74 "recognize capital letters and periods in print texts, capitalize first letter of own name" p.78
Grade 1	"name and match the upper and lower case forms of letters" p. 26 "print letters legibly from left to right, using lines on a page as a guide, use appropriate spacing between letters in words and between sentences" p.66
Grade 2	"print legibly and efficiently, forming letters of consistent size and shape, and spacing words appropriately, use margins and spacing appropriately" p.66
Grade 3	Enhance legibility "print legibly, and begin to learn proper alignment, shape and slant of cursive writing, space words and sentences consistently on a line and page" p. 67
Grade 4	Enhance legibility "write legibly, using a style that demonstrates awareness of alignment, shape and slant" p. 67

APPENDIX V SASKATCHEWAN

Ministry of Education Province of Saskatchewan (2010 December 30). English language arts curriculum kindergarten to grade 4. Retrieved from Government of Saskatchewan, Education website: http://www.education.gov.sk.ca/ela

	Outcomes
Kindergarten	"CCK.2: Use and construct symbols, pictures, and dramatizations to communicate feelings and ideas in a variety of ways." Indicators "Demonstrate knowledge of upper and lower case letters" "CCK.4 Create messages using a combination of pictures, symbols, and letters." Indicators "Attempt to copy letters or words from the environment (eg. Books, chart paper poems, word wall, name cards, public signs) to express ideas or understanding.
Grade 1	"Hold pencils, crayons, and markers with a comfortable and correct grip; use correct letter and number formations (capital and small letters); leave spaces between words" Exceeding Expectations "Forms letters fluently and automatically. Uses upper and lower case letters correctly and consistently" Meeting Expectations "Uses, consistently, appropriate letter formation and spacing on lined page in independent writing; uses upper and lower case letters correctly and consistently (e.g., name)." Beginning to Meet Expectations "Uses, consistently, appropriate letter formation with spaces between words in independent writing" Not Yet Meeting Expectations "Forms, in a legible manner, all upper and lower case letters taught. Begins to use lower case letters correctly in writing."
Grade 2	Exceeding Expectations "Forms letters fluently and automatically" p.38 Meeting Expectations "prints legibly to form letters and words of consistent size, shape, and spacing in daily writing using an efficient pencil grip" p. 39 Beginning to Meet Expectations "prints legibly using appropriate letter formation (i.e., size and shape) and spacing" p. 40 Not Yet Meeting Expectations "forms, in a legible manner, all upper and lower case letters taught" p.41

	Outcomes
Grade 3	Exceeding Expectations “cursive writing is used confidently” p.39 Meeting Expectations “cursive writing is used with some support” p. 40 Beginning to Meet Expectations “cursive writing is not always used and a writer needs support and instruction. Errors interfere somewhat with communication” p. 41 Not Yet Meeting Expectations “The profusion of structural and mechanical errors, including handwriting, makes the message difficult to understand. Errors seriously interfere with communication” p. 42
Grade 4	Exceeding Expectations “cursive writing is used confidently” p.40 Meeting Expectations “cursive writing is used with some support” p. 41 Beginning to Meet Expectations “cursive writing is not always used and a writer needs support and instruction. Errors interfere somewhat with communication” p. 42 Not Yet Meeting Expectations “The profusion of structural and mechanical errors, including handwriting, makes the message difficult to understand. Errors seriously interfere with communication” p. 43

APPENDIX W MANITOBA

Manitoba Education and Training (2010 December 30), English language arts kindergarten to grade 8. Retrieved from Manitoba Education website: http://www.edu.gov.mb.ca/k12/cur/ela/docs/outcomes/index.html

	Outcomes
Kindergarten	"4.3.3 Punctuation and Capitalization: Recognize own name, upper and lower case letters, familiar logos, and periods."
Grade 1	'"4.2.3 Enhance Legibility: "Strive for consistency in letter size and shape; print letters legibly from left to right horizontally, using lines on a page as a guide; explore and use the keyboard to produce text."
Grade 2	"4.2.3 Enhance Legibility: Form letters and words of consistent size and shape; print legibly using correct letter formation and spacing; explore and use the keyboard to compose and revise text."
Grade 3	"4.2.3 Enhance Legibility: Print and write legibly, developing a personal style; format text and space words consistently on a line and page or on an electronic screen."
Grade 4	"4.2.3 Enhance Legibility: Write legibly, with increasing speed, using a handwriting style that is consistent in alignment, shape, slant, and spacing; experiment with the use of templates, formatting, and familiar software when composing and revising."

APPENDIX X ONTARIO

Ministry of Education, Province of Ontario (2010 December 30), Curriculum documents. Retrieved from Ontario Ministry of Education website: http://www.edu.gov.on.ca/eng/curriculum/elementary/subjects.html

	Outcomes
Kindergarten	"2.8 Demonstrate knowledge of most letters of the alphabet in different contexts (e.g. use a variety of capital and lower-case manipulative letters in letter play; identify letters by name on signs and labels in chart stories, in poems, in big books, on traffic signs)" p.85 "4.1 Demonstrate an interest in writing (e.g. choose a variety of writing materials, such as adhesive notes, labels, envelopes, coloured paper, markers, crayons, pencils) and choose to write in a variety of contexts (e.g. draw or record ideas at learning centres) pg. 88 "4.2 demonstrate an awareness that writing can convey ideas or messages"
Grade 1	"3.7 Use some appropriate elements of effective presentation in the finished product, such as print, different fonts, graphics, and layout (e.g. use drawings, photographs, or simple labels to clarify text; print legibly; leave spaces between words)." pg 44
Grade 2	"3.7 Use some appropriate elements of effective presentation in the finished product, including print, different fonts, graphics, and layout (e.g. use legible printing, spacing, margins, varied print size, and colour for emphasis…)." Pg 58
Grade 3	"3.7 use some appropriate elements of effective presentation in the finished product, including print, script, different fonts, graphics, and layout (e.g. use legible printing and some cursive writing; use different font sizes and colour on a poster to attract attention; use proper paragraph form including spacing and margins…)." Pg 72
Grade 4	"3.7 use some appropriate elements of effective presentation in the finished product, including print, script, different fonts, graphics, and layout (eg. Use legible printing and some cursive writing; use different font sizes and colours to distinguish headings and subheadings from the body of the text; …)." Pg 88

APPENDIX Y NEW BRUNSWICK

New Brunswick Department of Education (2010 December 30), Curriculum development kindergarten to grade four. Retrieved from New Brunswick Department of Education and Early Childhood Development website: http://www.gnb.ca/0000/anglophone-e.asp#cd

Reading and Writing Achievement Standards Curriculum. A component of Atlantic Canada English Language Arts Curriculum (Entry- Grade 9). (September 2008- For Public Use)

	Outcomes
Kindergarten	Appropriate Achievement "Print most upper- and lower-case letters; use capitalization indiscriminately' tend to use upper- and lower-case letters randomly" pg. 26 "Demonstrate left-to-right and top-to-bottom directionality" pg 26 Strong Achievement "Print most upper- and lower-case letters" pg. 27 "Demonstrate conventional directionality" pg. 27 "Show general control of conventional spacing" pg 27
Grade 1	Appropriate Achievement " Use conventional spacing between words" pg 34 Strong Achievement "Use conventional spacing between words" pg 35
Grade 2	Writing Strategies and Behaviours Strong Achievement "Write fluently due to increased control of conventions" page 37
Grade 3	Writing Strategies and Behaviours Strong Achievement "Write fluently due to increased control of conventions" page 33
Grade 4	Writing Strategies and Behaviours Strong Achievement "write independently due to increased control of conventions" page 35

APPENDIX Z NOVA SCOTIA

Nova Scotia Department of Education (2010 December 30), English language arts curriculum documents. Kindergarten, Primary and Grades 4-6. Retrieved from Government of Nova Scotia, Education website: http://www.ednet.ns.ca/index.php?t=sub_pages&cat=90

Nova Scotia Education Learning Outcomes Framework Grades Primary-Six Draft, Nov 16, 2010.

	Outcomes
Kindergarten	"4.2 understand basic concepts of print including directionality, word, space, letter and sound" Pg 5 "10.2 use some conventions of written language: develop the concept of directionality (left to right; top to bottom)…begin to use spacing between words"…understand that letters can be written in upper and lower case forms (but often tend to use them indiscriminately" Pg 6
Grade 1	"4.2 expand their understanding of concepts of print" pg 27: … upper and lower-case letters have specific forms and functions (first word in sentences and proper names)" pg 28 "10.2 use some conventions of written language: use conventional spacing between words" pg 29
Grade 2	No handwriting outcomes documented.
Grade 3	No handwriting outcomes documented.
Grade 4	No handwriting outcomes documented.

APPENDIX AA PRINCE EDWARD ISLAND

PEI Specific Curriculum Outcomes (2010 December 30), English language arts, kindergarten to grade 4. Retrieved from Department of Education and Early Childhood Development, Prince Edward Island website: http://www.gov.pe.ca/eecd/index.php3?number=1036237&lang=E

Prince Edward Island, Education and Early Childhood Development English Programs Writing Achievement Standards

	Outcomes
Kindergarten	"4.5 develop the concept of directionality" pg 86; "4.7 understand that letters can be written in upper and lower case (use them indiscriminately)" pg 86; "4.11 begin to use spaces between words" pg 86.
Grade 1	Appropriate Achievement "Use conventional spacing between words" pg 2 Strong Achievement "Use conventional spacing between words" pg 2
Grade 2	Writing Strategies and Behaviours Strong Achievement "Write fluently due to increased control of conventions"
Grade 3	Writing Strategies and Behaviours Strong Achievement "Write fluently due to increased control of conventions"
Grade 4	Writing Strategies and Behaviours Strong Achievement "Write independently due to increased control of conventions"

APPENDIX AB NEWFOUNDLAND & LABRADOR

Atlantic Canada English Language Arts Curriculum: Newfoundland and Labrador (2010 December 30) English language arts curriculum guides: Early beginnings. Primary and Grade 4-6 Retrieved from Newfoundland and Labrador Department of Education website: http://www.ed.gov.nl.ca/edu/k12/curriculum/guides/english/index.html

	Outcomes
Emergent (K-1)	"Develop the concept of directionality (left to right; top to bottom)… begin to use spacing between words… understand that letters can be written in upper and lower case forms (but often tend to them indiscriminately)" pg 48 & 122
Early (1-2)	"Use conventional spacing between words" pg 48
Transitional (3)	"Use manuscript and/or cursive writing in a legible manner" pg 50 By End of Grade 3, students should: "Create written and media texts using a variety of forms… and… use some conventions of written language" pg 25

APPENDIX AC NORTHWEST TERRITORIES

Northwest Territories English Language Arts Curriculum (2010 December 30), Curriculum services- English language arts kindergarten to grade 6. Retrieved from Education, Culture and Employment, Northwest Territories website: http://www.ece.gov.nt.ca/

Northwest Territories English Language Arts Curriculum –Draft 2009

	Outcomes
Kindergarten	"2.1.4 a. identifies some letters of the alphabet (upper and lower cases)" pg 2-23 "2.1.5 a. recognizes that print has meaning and/or that scribbles represent words" pg 2-31 4.2.3 form recognizable letters and begin to use a computer" 4-33 4.2.3 a. "forms some recognizable letters and numbers in multiple media" pg 4-35 4.3.2 a. Writes own name" pg. 4-55 4.3.2 c. Copies environmental print and words of personal significance" pg. 4-55 4.3.3 a. Uses some upper and some lower case letters in personal representations" pg. 4-61
Grade 1	2.1.4 a. "Identifies all letters of the alphabet (upper and lower cases)" pg. 2-23 4.2.3 Print letters legibly and explore keyboarding and word processing" 4-33 4.2.3 a. Prints upper and lower case letters and numbers legibly" pg 4-35 4.2.3 d. Begins to demonstrate consistency in size and shape of letter and number formations… using lines on the page as a guide" pg 4-35 4.2.3 e. Begins to use word boundaries (spacing)" pg 4-35
Grade 2	4.2.3 Print letters consistent in size and shape and begin to develop some proficiency with keyboarding and word processing" pg 4-34 4.2.3 a. Demonstrates consistency in size and shape of letter (upper and lower) and number formations" …using lines on the page as a guide" 4-36 4.2.3 b. Uses word boundaries (spacing) 4-36
Grade 3	4.2.3 Print and begin to write while continuing to develop proficiency with keyboarding and word processing" pg 4-35 4.2.3 a. Demonstrates consistency in size and shape of letter (upper and lower) and number formations" …using lines on the page as a guide" 4-37 4.2.3 b. "Uses word boundaries (spacing) consistently on a page and on an electronic screen" 4-37 4.2.3 f. Begins to write letters (cursive)" pg 4-39
Grade 4	4.2.3 "Write legibly and fluently while continuing to develop proficiency with keyboarding and word processing: uses related vocabulary" p. 4-37 4.2.3 a "Uses handwriting regularly, improving legibility and fluency. Legibility refers to: shape, slant, and spacing" 4-37 4.2.3.b. Uses word boundaries (spacing) consistently on a page and on an electronic screen" 4-37

APPENDIX AD NUNAVUT

Nunavut English Language Arts Curriculum is taken directly from the Common Curriculum Framework for English Language Arts, Kindergarten to Grade 12, Western Canadian Protocol for Collaboration in Basic Education, 1998.

	Outcomes
Kindergarten	… "Recognize that print is organized from top to bottom and left to right"… pg 20; … "Demonstrate curiosity about and experiment with letters" pg 28 … "Form recognizable letters and use letters and directional arrow keys on the keyboard" pg 52. …"Recognize own name, capital letters, and periods" pg 56
Grade 1	…"Use syntactic, semantic, graphophonic, and pragmatic cues (such as differentiating between letters and words…) to construct and confirm meaning" pg 20 …"Strive for consistency in letter size and shape; print letters legibly from left to right horizontally, using lines on a page as a guide; explore and use the keyboard to produce text" pg 52
Grade 2	…"Form letters and words of consistent size and shape; print legibly using correct formation and spacing; explore and use the keyboard to compose and revise text" pg 52
Grade 3	…"Print and write legibly, developing a personal style; space words consistently on a line and page or on a electronic screen." Pg 52 …"Prepare neat and organized compositions, reports, and charts that engage the audience" pg 52
Grade 4	…"Write legibly, using a handwriting style that is consistent in alignment, shape, slant, and spacing and experiment with the use of templates and familiar software when composing and revising." Pg 53

APPENDIX AE FURTHER RESEARCH COMPLETED

Additional research has been completed as a result of the methodological limitations identified in this integrative review. The research presented here is considered a starting point. It is not inclusive of all the educational outcomes or factors contributing to the occupational injustice of handwriting, rather it is illustrative of the potential contribution this research can make.

The literature sources on the curriculum outcomes were identified by searching each provincial and territorial department of education website specifically for the keyword "curriculum". Once the curricula were identified, the English Language Arts curricula, kindergarten to grade four, of the common curricula as well as the individual provincial and territorial curricula outcomes were searched for keywords. The keywords searched were limited to: writ*, text, conventions, graphophonics, presentation and legibility. The outcomes of the common curricula were described below. The specific outcomes of the provincial and territorial curricula on handwriting are found within the Appendices R to AD.

Western And Northern Canadian Protocol (WNCP)

It was recognized by the Ministers of Education in 1993, that there was utility in joining western provincial and northern territorial efforts to create a standard for basic education. Therefore, the Ministers of Education in Alberta, British Columbia, Manitoba, Northwest Territories, Saskatchewan and Yukon formed a group combining experts from each province and core subject areas. Nunavut joined in 2000.

In December of 1993, the ministers of education signed the Western Canadian Protocol for Collaboration in Basic Education (WCP), K-Gr. 12. The modus operandi was to provide a collaborative approach to basic education and provide common educational outcomes in English, mathematics, and science. The group members worked in partnership because of the collective values they placed on: "high standards of education,

common educational goals, removing obstacles to the access of educational opportunities for students, including improving the ease of transfer from jurisdiction to jurisdiction, optimum use of educational resources" (Western and Northern Canadian Protocol, 1998, pg vii).

The Common Curriculum Framework for English Language Arts, Kindergarten to Grade 12, Western Canadian Protocol for Collaboration in Basic Education was released in 1998. The handwriting outcomes from kindergarten to grade four are highlighted in Appendix R. The synopsis of the handwriting outcomes in the English language arts curriculum suggests the skill of handwriting is initiated in kindergarten and is expected to continue throughout the primary education grades 1, 2, 3 and 4. Kindergarten students are expected to demonstrate a curiosity for letters and form recognizable letters, which are organized appropriately on the page. While in grade one, the expectations increase to consistency in size and shape. Organization of work is expected with the introduction of using the lines on the page. By grade two, it is expected that children have developed the skills necessary for consistent and correct legibility, form, sizing, and space. Personal style is introduced in grade three, and academic products are neat and organized. Handwriting development: consistency and style are consolidated by grade four. The general interpretation of this curriculum indicates that foundational skills for handwriting are expected to develop in kindergarten, and are strengthened and expected through the progression of the grades. However, the suggestions for learning and teaching per handwriting outcome are not reported within the curriculum document.

Atlantic Canada English Language Arts Curriculum

In the same year the Western Canadian Protocol for Collaboration in Basic Education was signed; 1993, the Atlantic Provinces formed a similar assembly. The Atlantic Provinces, namely, New Brunswick, Newfoundland and Labrador, Nova Scotia and Prince Edward Island recognized that research and technology in education were experiencing exponential growth and the impacts on childhood education was substantial (Foundations for the Atlantic Canada Common Curriculum). A common basic education curriculum was created in 1994.

In 1998, Atlantic Canada released "Atlantic Canada English Language Arts Curriculum Elementary K-3 841860, Department of Education Curriculum Development Branch. Handwriting outcomes are documented in terms of the stage of the learner: Emergent, Early and Transitional. The specific outcomes of each stage are relatively vague in comparison to the Western and Northern Canadian Protocol. The Atlantic Canada common curriculum indicates that Emergent Learners will understand that the alphabet can be written in capital and lower case forms and will develop the concepts of directionality and spacing, whereas, Early Learners will use conventional spacing between words (see Appendix S).

The strength within the Atlantic Canada common curriculum is that handwriting is explicitly discussed within the *Program Design and Components* section of the curriculum. The formation of letters was described within the graphophonic cueing system. An excellent principle of handwriting is highlighted in the statement: "writing is probably the single most important activity for focusing on and practicing letter formation (printing and cursive writing), letter-sound relationships, and spelling." (New Brunswick Curriculum, 1998, p. 190). This statement forms a foundation of understanding that printing and cursive writing skills need to be practiced. One may also extrapolate from this statement that letter formations are the building blocks to successful writing. Unfortunately, within this section of the curriculum, the descriptions provided for teaching and learning do not include specific letter formation strategies.

The Program Design and Components has a dedicated section on handwriting. The curriculum states: "handwriting is a functional tool, which must be integrated into daily activities through instruction, with the teacher modeling standards for legibility and opportunities for practice" (New Brunswick Curriculum, 1998, p. 217). In addition, this section provides information on the purpose of handwriting instruction and practice, specific comments on size, proportion, speed, cursive writing and specific ways in which teachers can help students with handwriting, including the foundational skills required, activities, and teaching methods are included (New Brunswick Curriculum).

Discussion Of The English Language Arts Curriculum Outcomes

A comment worthy of note is that both common curricula document the expectations for integrating technology, namely the development of keyboarding and computer skills. The development of these skills is in parallel to the developments of handwriting skills. The curricula outline foundational skills, which are developed in kindergarten, and are built upon with increasing complexity through the progression of the grades. Explicit outcomes for keyboarding development and computer use, teaching and learning strategies are documented. Remarkably, the Atlantic Canadian English Language Curriculum, although lacking in detailed handwriting outcomes per grade, is generous with technology outcomes. This may be a reflection Atlantic Canada values and or it may reflect the trend and exponential influence and benefits technology presents with in education.

In addition to the two assemblies creating a common curriculum, every province and territory details provincial and/or territorial curriculum outcomes for English language arts. Although the common curricula are created for use within all founding provinces, every province and territory presented the information in a unique provincial document. The exception to this is the territories: Nunavut, and the Yukon. Nunavut provided a reference to The Common Curriculum Framework for English Language Arts, Kindergarten to Grade 12, Western Canadian Protocol for Collaboration in Basic Education, whereas Yukon Territory, referenced the British Columbia English Language Arts curriculum webpage. Ontario and Quebec have created their own curricula, although curriculum expectations for Quebec were not described within this review because it was in French.

The purpose of modifying the common curriculum to create a unique provincial or territorial curriculum presents positive and negative outcomes. The positive outcome is that slight variations in the curriculum may reflect the specific values or culture of the province. This would enable the curriculum to reflect the needs of the population it serves. However, the common curricula were created not only to maintain a high standard of education from jurisdiction to jurisdiction, but also to generate efficiencies in the

ministries of education by collaborating on a common document. Changing the document provides the opposite outcome. In spite of this, exceptional inclusions and or variations per province and territory are noted in addition to limitations. Appendices T to AD, illustrate the provincial and territorial English Language Arts curriculum specific to handwriting outcomes found within the website for each Department of Education. It is suggested that this research will set the stage for other research studies to explore the impact of the handwriting curriculum outcomes and possibly, to explore the possible conditions contributing to an occupational injustice in handwriting.