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Modifiability of the Psychomotor Domain

by

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ABSTRACT

A case study design was used to determine if a cognitive approach, based on socio-constructivist theory, could facilitate gross motor skill acquisition in preschool aged children with Down Syndrome (Ds). After a pre-assessment, seven children, ranging in age from 2 years 10 months, to 5 years 9 months, participated in six trials each for sliding and jumping activities. Two intervention formats were used with each child. The command and practice (C&P) format focused primarily on the physical aspects of motor skill acquisition while the graduated prompt (GP) format was designed to influence the cognitive domain. After each intervention session, tasks measuring children's declarative knowledge of the motor skills were presented. Procedural knowledge was measured by observing the child in gross motor play at a large playground one day and one week after the intervention session.

Information about each child's sliding and jumping related behaviours was collected using video observations, floor plan / maps, anecdotal notes, parent interviews, and journaling. Qualitative and quantitative information was reported in a case by case approach and compared using cross-case analysis.

Patterns of improved and more independent psychomotor behaviours emerged during the intervention session, were observed later in free play sessions, and confirmed by parents. For the most part, current theories of motor learning and control were unable to explain the changed motor behaviours of the children. Therefore, a hypothetical description which blends motor learning with Vygotsky's socio-historical theory, is presented as the explanation for why and how psychomotor skill improvements were made.

This project determined that the psychomotor domain is modifiable. Implications are that the GP format is a useful assessment model for the psychomotor domain, and therefore, when teaching children with Ds gross motor skills, people should use verbal, visual, gestural / kinesthetic prompts, demonstrations of skills displayed with dolls and models, and explanations aimed at influencing cognitive understandings of motor skills. Future research options include motor theory development with Vygotsky's proposals, finding new ways to assess psychomotor knowledge, and using declarative and procedural knowledge when teaching motor skills to children with movement disorders / motor delays.

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DEDICATION

To Edward, Kelsey, Brett, Fran, Barb, and Kathy, for their work and input during the preliminary sessions last fall.

To the parents of children with Down syndrome who dared enough to try a new educational approach with their sons and daughters and willingly participated in this research project.

To all others who have family members and friends with Down syndrome. I ask you to consider alternate ways to address educational issues and other related issues in the future.

To Don, Joal, Jessiya, Sanchia, and Jonah, because this project took much longer than I thought, and you had to give much to the running of our family. Let this dedication be one small way I can give back to you.

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LIST OF ABBREVIATIONS

Bayley Scales of Infant Development (BSID)
Canadian Down Syndrome Society (CDSS)
Central Nervous System (CNS)
Command and practice (C&P)
Day Later (D-L)
Down syndrome (Ds)
Graduated prompt (GP)
Intervention (Intv)
Peabody Developmental Motor Scales (PDMS)
Psychology Licensure Exam Review (PLER)
Week Later (W-L)
Zone of Proximal Development (ZPD)

PREFACE

The more that I read and study, seeking to learn more about certain aspects of life, the more I have come to understand the little I really know about the wonder of this world and everything in and around it. God has created an incredible masterpiece, and even the wisest man who ever lived was unable to comprehend how all things fit together (Ecclesiastes 1:1 to 12:14). My belief is that God simply wants us to do the best we can with the skills, abilities, knowledge, and gifts that He has given to us (Ecclesiastes 9:10). This research project was born out of a desire to please God in this, and to help people who have difficulties in learning and developing in the psychomotor domain.

CHAPTER ONE
THE MYSTERY OF MOVEMENT
Questions, questions, questions...

I was curious. It seemed as if I had a hundred questions. How would children react if I tried teaching motor skills in ways that differed from the traditional command and practice style, where adults tell children exactly what to do and then simply ask them to practice the tasks over and over again? If a child showed some natural interest in a particular motor skill, would it be possible to help that child think about and focus on various aspects of that motor skill before they were asked to perform it physically? If I used a "cognitive" teaching approach explaining the what, why, how, where, and when of movement, before the child was asked to use their muscles, would that alter the child's motor performance? Could the child show their understanding of motor concepts in other ways? What strategies might facilitate such a transfer of knowledge to the child? Further, if the child was free to reflect, reconstruct, and rethink their motor experience after it was over, rather than being told to continue practicing, what would the child do? Would the child automatically perform the motor skill again; would the youngster spend time reworking their understanding of the skill; or would the child simply go on to another activity -- related or not? Would the child be able or willing to communicate or display some understanding they had developed about the motor skill? How could I assess their motor skills with a focus on what types of interventions would promote change? Would it be possible to do that in an hour or two? Theory and practice from several disciplines suggested that a new teaching /assessment approach would work, so I decided it was worth investigating.

For several weeks, I watched Mick and two other children play at a large public indoor playground. During these observations, the children's movements on the playground equipment were documented. Each child was active in play and explored the playground equipment spontaneously. However, some areas, such as the slides and a jumping room, seemed more interesting to the children than other areas. In particular, it was easy to determine that Mick enjoyed being near the slide; he seemed content to sit and watch other children descend it. However, he was not observed gliding down the slide on his own.

Several weeks later, I spent about five minutes showing Mick information about sliding in new and different ways. I did not tell him how to position his own body or what to do when sliding -- I simply utilized props such as: a poster of a slide, several pictures of children and cartoon characters in sliding action, and a wooden artist's manikin which was manipulated in ways to resemble proper sliding posture and motion. Meanwhile, I explained to Mick what kinds of body positions were important in sliding activities and why those postures were valuable. Thereafter, Mick and I worked our way up through a maze of play-ground equipment until we came to the top of a long straight slide.

Immediately, Mick sat down and prepared to descend this piece of play-ground equipment all by himself. While sliding down, he placed his arms outwards and momentarily touched the sides of the plastic tunnel slide. At the bottom, he self-initiated some vocalizations, "EEeee, EEeee, Yaaaa", and then without any prompting, he walked over to a piece of paper on the floor, picked up a felt marker, and drew a picture. There appeared to be many symbols and markings that were related to the physical experience he had just completed. Then he picked up the artist's manikin and manipulated it so that the arms and legs were extended outwards as in sliding position. He adjusted the trunk of this wooden body slightly so that it resembled a sitting position, and then made a sliding motion with the manikin on the side of his drawing. Self-initiated, Mick said, "Slide", and pointed at a large picture poster of a slide while placing the manikin, with legs together, beside him on the floor. After drawing two other pictures, Mick said, "Slide" again while pointing at a small 'real-life' picture of a child descending a slide in a playground equipment catalog.The time spent focusing and reflecting on an activity that he had just participated in was not yet complete, and his expressions of knowledge about the sliding activity now became more physically active!

Mick picked up the manikin again, positioned both arms and legs outwards, and placed it squarely on the large poster sized picture of a slide. He quickly pulled the manikin along the picture making the wooden body appear to slide. Then, taking this wooden body with him, he walked over to the slide through which he had just descended minutes earlier. He crawled into the bottom section of the slide, sat up, and manipulated the arms and legs of the wooden

manikin in a distinct outward fashion. Mick carefully placed this wooden doll face up and on it's back, in the center of the slide, as high up the slope as he could reach. Next, while stabilizing the manikin in the position described above, Mick adjusted his own posture by rolling over onto his stomach. Then, while sliding backwards, he gently pulled the manikin, face up and feet first, down the slide. It appeared that he had developed a solid understanding of how the body needed to be positioned and what the body needed to do while sliding!

Within the hour, and self-initiated, Mick took the manikin and climbed up to the top of a double spiral tunnel slide, which is where he liked to sit and observe other children going down the slide. I followed him up there to see what he would do. Once again, Mick prepared the manikin for a descent down this particular slide. The wooden doll was adjusted to proper position -- lying on its back, face up, with feet first and arms and legs spread outwards. He said, "Slide", pointed at himself, and then sent the manikin down the circular tunnel slide. He cocked his head slightly and appeared to listen carefully as the artist's manikin 'clattered' it's way to the bottom of a double spiral. Then we agreed to go down the slide together. Once there, he retrieved the wooden doll at the bottom, and taking this manikin with him, he continued to explore other slides and locations in this playground in new and unique ways.

More Questions...

Wow! What generated this prolonged and concentrated focus on sliding activities? Was it related to any of the teaching tools shown to Mick just before he descended the slide? If so, which prompt / intervention method influenced Mick the most -- which was most effective? Was he simply showing me what he already knew about sliding? Were the props and other forms of expression more satisfying and freeing for him -- simply providing alternative ways for him to display his knowledge? Did the various intervention tools provide a refreshingly different way for Mick to rethink, revisit, reflect, and / or reconstruct the activity he just participated in? In short, did one or another prompt / intervention technique actually influence the thought processes involved in the physical activity, and, did that cognitive comprehension result in new and significant performances and understandings about movement? Would this happen with

other boys and girls like Mick, young children with Down syndrome (Ds)?

If a child with Ds such as Mick, has been involved in a physical activity and then is willing and able to display his understanding of the movement experience through self-initiated expressions of knowledge, then parents, teachers, and other practitioners may also be able to use similar prompts or forms of intervention before motor behaviours are performed -- as a way to awaken increased proficiency of psychomotor skills. But, how would one assess the child's potential for change in the psychomotor domain?

Personal Journey

This project was born out of a predicament I found myself in, starting about four years ago. As a result of a life-long interest in interacting with people with disabilities, I had worked and volunteered in many programs. Most programs focused on meeting the "special needs" of people who had various challenges. An underlying philosophy prevailed in the different agencies; there were "correct" ways to train and teach people with disabilities. I observed such practices for many years and, for the most part, participated in the commonly used methods. About the same time, I was completing a large research project that investigated the effects of a structured program of fundamental motor skills on the gross motor skill acquisition of preschoolers with Ds. The research was conducted at an agency which supported the use of long-term, adult-led, and highly organized programs to influence learning and development.

In addition to volunteering and conducting research at the agency, I was a graduate student who was reading, listening, and learning about different ways to work with individuals who experience significant challenges in their lives. I began to feel uncomfortable with the way my study had been conducted and the teaching methods adults typically use with children with special needs. I was curious if other teaching formats would also be effective in assisting people to gain skills, and worked towards finding new solutions. However, one interest remained constant; the desire to blend kinesiology, education, and psychology; looking in particular at children's acquisition of fundamental movement skills.

My interest in studying movement of the human body grew from childhood onward. During the school years, physical education was my favorite subject,

and as early as my teen years, I often found myself watching others -- being intrigued by the way people moved. In addition to this, I had also befriended and established many contacts with people who had various disabilities. Some of my friends had cognitive delays, while others were hearing impaired, visually impaired, or had physical disabilities. These experiences made it very easy to interact with people who were marginalized. Therefore, when I was seventeen years old and "ready to work", I applied for and obtained a job at a large "mental institution" where I was assigned to work with "female low-grades". I had never heard such a derogatory term and was shocked to discover the women's living conditions and how they were paraded through highly structured routines and daily schedules that suited the staff. I wondered, but never dared to ask, what these women had done to deserve this treatment and to be confined to such an environment. I sensed I would not get a satisfactory answer. I worked there for eight months, saving enough money to start my post-secondary education.

In my early twenties I went to university to study physical education. I soon recognized that I was different from my classmates, as most were "athletes" and participated in the various sport teams, while I loved studying the "science of movement" in courses like anatomy, human physiology, and human growth and development. One course, adapted physical activity, was particularly interesting to me, since it fostered my interest in movement and working with people with various disabilities. I finished two degrees and eventually entered the work world. Although my primary interest was to teach physical education, because of my substantial experience with people with "disabilities", I was invited and encouraged to teach students with "special needs". Again I entered environments where particular programming practices were expected. My pupils had developed an intense dislike for school work, but, since my classroom was isolated and administrative staff seldom visited, I altered curriculum, goals, and teaching methods to accommodate student interests. I loved those years!

Then I chose to remain at home to raise our four children. However, I continued to volunteer in various ways with people who had disabilities or learning problems. It seemed as if my interest in physical activity had waned over the years. But this was about to change.

When our youngest child entered preschool, I explored the possibility of

returning to work in special education, and was told that I would need to return to university to obtain a diploma for teaching special education. That did not make sense to me, as I had already taught full-time in that area for five years. I visited the university anyway and began to investigate the option of returning to school. Many "doors opened", and soon after, I returned to full-time graduate study. Research designs in my "home" department were framed within a positivist world view where one used quantitative methods in objective ways to determine cause and effect relationships between variables. Hence my first research project was modelled in this way.

The research was conducted as planned; however, when tracking results, I discovered that certain individuals did not respond to interventions in the same way others did, and situational factors seemed to influence research subjects differently. This variability of humans did not surprise me. I also found that the research methodology I used, made it impossible to quantify certain factors or to "prove" that certain relationships existed. As a result, I needed to modify my methods of inquiry, and use another perspective to accommodate these differences. I now know that I adopted a post-positivist view, but this did not last for long.

After the research project was complete, I worked part-time at the agency where the research was conducted. Because of the discomfort I felt in using highly structured methods in my research, I tried to incorporate new ways of interacting with the preschoolers. This involved teaching children only after they displayed some interest in a certain motor skill -- I felt it was more respectful of their educational needs and desires. But, such practices did not fit with the philosophy and purposes of the agency. I made a choice to stop working there. However, at the year-end party, something happened which pricked my interest.

Numerous parents and staff were talking and laughing amongst each other while the preschoolers played spontaneously in all locations of a large indoor playground. I stood to the side and watched how, after every few minutes, adults would interupt the child's play and point or tell them to go to new areas of the playground or try new activities -- whether the child was interested or not! This happened over and over again during the course of the morning. While some children followed the adult commands, many others resisted. Silently, I

questioned this practice and wondered if children with developmental delays could acquire motor skills without responding only to direct instructions. It seemed that they, just as other young children, deserved the opportunity to try to construct their own knowledge of concepts and events. I sensed that there must be a way to assess each child's potential for change in the motor area, because I had read about various forms of assessment that claim to be able to measure a child's modifiability in the cognitive domain. Could theories and principles which are used to explain changes in intellectual learning and development also apply to the motor area? I believed it was worth investigating, and so this project was born!

Introduction to the Problem

A post modern perspective invites people to change the way they think about set theories, issues, and practices and to have freedom to dialogue about these concepts (Creswell, 1998). This project has that goal in mind, asking the reader to consider the benefits of introducing new and different educational philosophies and practices for assessing and teaching children with Ds. You are requested to do this because this research project and other preliminary work suggests that alternative teaching styles and assessment methods may have some merit.

It is impossible to address all aspects of education in one research project. Therefore, this research is focused primarily on the psychomotor domain because movement related activities are an integral need for young children, and this area is sorely neglected in educational psychology. Except for motor literature which is filled with lists and descriptions of the skills preschool aged children should be doing at a particular age, there is very little known about how young children actually learn and acquire gross motor skills. This is a valuable area to study for many reasons. Findings may stimulate new ways of thinking about how motor learning and development occurs in young children; results may help practitioners find new ways to assess the psychomotor abilities of children; and teachers, parents, therapists, and other clinicians may develop new ways to intervene with and support children who have difficulties with movement skills. In addition, my background in kinesiology, education, and

educational psychology has resulted in an intense desire is to gain knowledge about the value of utilizing cognitive processes to facilitate learning and development in the psychomotor domain.

Within the field of kinesiology, much study, research, and theory development has been conducted which is directly related to the acquisition of motor skills or motor behaviours. However, for years, there is a sense that the theories related to motor development, learning, and control need to be revisited, because there is an absence of global frameworks which apply to this area and there appears to be large discrepancies between theoretical explanations and practical applications, which has resulted in disconnected, lopsided, and incomplete endeavors. In addition, there is a growing desire to approach this area using a more interdisciplinary perspective (Abernathy & Sparrow, 1992; Abernathy, Thomas, & Thomas, 1993; Cratty, 1973b; Kelso, 1982; Keogh, 1977; Keogh & Sugden, 1985; Magill, 1993; McPherson, 1993; Reid, 1990; Schmidt & Fitzpatrick, 1996; Seefeldt & Haubenstricker, 1982; Whiting, Vogt, & Vereijken, 1992; Wickstrom, 1983; Worringham, Smiley-Oyen, & Cross, 1996).

To address this using an interdisciplinary perspective, one might search in other disciplines for theories that could explain motor learning. By investigating such models or theories and then applying them to the motor learning field, practical ways to expedite psychomotor learning and development may unfold. For example, rather than using a "physical skills-based" approach, an educational or "cognitive" approach may also enhance motor skill acquisition.

There is support in the literature for blending cognitive / psychic processes with movement (Cratty, 1989; Keogh & Sugden, 1985; Kerr, 1982; Mosston & Ashworth, 1994; Rink, 1996; Rink, French, & Tjeerdsma, 1996; Seefeldt, 1988; Starkes & Allard, 1993). Fitts and Posner (1967) and Gentile (1972) even developed theories which point out the necessity of utilizing cognitive understanding in motor learning. Yet, this perspective has seldom been applied with children and even less frequently to those with developmental delays.

Currently, there is no in depth literature on the psychic processes that a child engages in, or the specific strategies / teaching prompts that help a child learn and develop gross motor skills. While there are numerous references which suggest the use of verbal, visual, and physical prompts to teach motor

skills (Collier & Reid, 1987; Cratty, 1989; Sherrill, 1993; Stephens, 1971; Watkinson & Wall, 1982; Wessel, 1976, 1980a, 1980b), teaching tips focus primarily on physical aspects of the skills and the categories of prompts seem too general. It is more important to know exactly what verbal, visual, and physical prompts will make a positive difference for a child who is acquiring motor skills. The use of very specific prompts may make it possible to determine whether or not the psychomotor domain is modifiable, and if so, which teaching tools and strategies are most effective. Therefore, by inviting several children to participate in a dynamic assessment process in which certain motor skills are taught using different techniques, and then observing them closely, one may be able to establish which forms of intervention modify the psychomotor domain. Benefits of studying this topic include being able to develop a clearer picture about the processes involved in motor learning and development, determine what teaching strategies seem to make a difference for individual children with Ds, and inform and educate practitioners working in such areas.

Children with Ds are typically taught using practices based on behaviorist philosophies (de Graaf, 1998; Dmitriev & Oelwein, 1988; Eichstaedt & Lavay, 1992; Sherrill, 1993; Watkinson & Wall, 1982). In contrast, the goal of this research is to study the value of using a cognitive approach, based on Vygotsky's (1978) socio-historical theory, to teach psychomotor concepts and skills to preschool aged children with Ds. A case study research design is the method used to investigate modifiability of the psychomotor domain.

The primary emphasis in this dissertation is not on the skillful performance of gross motor acts or the "product" per se, but on the "process" involved in psychomotor learning and development. The need to focus on process is supported by Wall (1990), Carnahan (1993), Chamberlain and Coelho (1993), Kaminsky (1998), Kelso and Clark (1982), and Roy (1990). They write that it is important to determine how movement is performed and the results of motor actions, for in this way, one may be able to measure both the product and processes involved in movement skill acquisition. Therefore, the main focus of this research will be on the learning, understanding and expressions of knowledge, and other behaviours related to two specific gross motor tasks.

Definitions

There are several key terms in this paper which warrant clarification. "Psychomotor" is a central concept and was first used when Bloom, Krathwohl, and Masia established a taxonomy of educational objectives approximately forty years ago (Gallahue & Ozmun, 1995). Since then psychomotor has had a number of different meanings; generally, it refers any motor response caused by a psychic process (Burton & Miller, 1998; Cratty, 1973b; Jansma & Decker, 1988; Keogh & Sugden, 1985; Sherrill, 1993). However, for the purposes of this paper, Kerr's (1982) definition will be used. He states that psychomotor learning is a psychological approach which focuses on how motor skills are learned and performed. He adds that by observing human motor behaviors, one seeks to construct models which explain how that behaviour is produced.

The terms "motor skills" and "abilities" have different meanings. Motor skills may be referred to only as "skills" but are considered "an action or a task that has a goal and that requires voluntary body and or limb movement to achieve that goal" (Magill, 1993; p. 7). Skill may also be used to indicate the quality of one's performance (Magill, p. 422). People can reach an action goal using a variety of movement patterns, and some movement patterns are qualitatively better, more mature, or more proficient expressions of performance than others -- they are more "skillful". Motor performances may be considered more "skilled" when actions are consistent, when relevant rather than non-meaningful cues are attended to, and / or the person is able to anticipate in advance what should or needs to be done during a specific motor action. In contrast, ability is a "general capacity of the individual" (Magill; p. 8) that underlies motor skill performances. For example, a person with the "ability" of multi-limb coordination is able to control and coordinate several limbs simultaneously.

The term "socio-constructivist" also has different meanings. Mertens (1998) refers to social-construction as a research paradigm in which reality, meaning, and knowledge is not discovered, but socially constructed; interactions between people influence each other, and these beliefs result in the use of qualitative research methods. For the purposes of this paper, socio-constructivism is intended to indicate an adherence to Vygotsky's (1978) beliefs about how cognitive development occurs in young children (Edwards, Gandini, Forman,

1998; Gandini, 1995; Rankin, 1995). Vygotsky believes that through multiple social interactions and exposure, children actively co-construct their own understanding of concepts, events, and experiences, which results in revised cognitive processes.

Finally, in this paper, the word "intervention" refers to a purposeful short-term intervening with another person, a type of prompt within an assessment, that may be less than one minute in duration. The intervention was conducted for the purpose of assessment. Unless otherwise indicated, it is not intended to mean a long-term program of instruction (Auxter, Pyfer, & Huettig, 1993; Bricker & Widerstrom, 1996; Burton & Miller, 1998; Dmitriev & Oelwein, 1988; Oelwein, 1995; Rynders & Horrobin, 1996; Sherrill; 1993, Watkinson & Wall, 1982; Wessel, 1976; 1980a, 1980b).

Purpose and Significance of the Study

The purpose of this research is to discover whether the psychomotor domain is modifiable -- specifically, if a cognitive form of intervention, utilized within a dynamic assessment, will facilitate motor learning and development in preschool aged children with Ds. This is not done to discredit or replace existing teaching strategies or various prompts used within other motor development programs. Rather, the investigation seeks to compare the effectiveness of a command and practice teaching format with the graduated prompt teaching format, and discover if and how specific graduated prompts influence the acquisition of gross motor skills.

The reason this topic is of interest, is that if findings show one brief application of a cognitive approach seems to make a positive difference in motor related activities and behaviours of a child, then one may infer that the psychomotor domain is modifiable using such processes. Such a discovery may result in the eventual development of new teaching methods and a new focus in the gross motor skill acquisition programs, not only for young children with Ds, but possibly for others who also experience delays in motor skill acquisition.

In addition to developing a "cognitive education approach" for helping children with movement problems and delays, research findings can be shared

with those already working in such fields. If physiotherapists and occupational therapists are made aware of current research findings, they can begin to alter and add the new teaching style and related techniques into their already established practices.

New forms of motor skill assessment may also be developed if research findings show that knowledge and understanding of psychomotor concepts and skills can be measured in ways other than individual motor skill performances alone. And, individuals specializing in this area may give parents and practitioners concrete examples and strategies to use when teaching a child concepts and skills which relate to certain motor skills. If research results show positive gains in all the research participants, then one may surmise that similar strategies may be beneficial when teaching different motor skills to other children with Ds (V. Hazle, personal communication, July 29, 1999).

CHAPTER TWO
CURRENT CONDITIONS

Introduction to the Background of the Problem

This chapter contains a detailed review of research and literature related to this project. The first section deals with general information about Ds and the impacts of this genetic condition. The reader will discover that children with Ds display difficulties in learning and development in all domains of behaviour; however, research shows that children with Ds are more motorically delayed than cognitively delayed.

Next, the past and present forms of intervention and findings of research projects that have studied motor development in young children with Ds will be presented. Embedded in this section are comments by scholars who suggest that ongoing practices may produce unfavorable effects and that research findings are not consistent. Fortunately, a strong message is given; researchers and practitioners must search for new and better ways to facilitate learning and development for children with Ds. A question follows: Are there new approaches or other ways to facilitate gains in gross motor skills?

The various approaches to motor learning are reviewed. The reader learns that some theories and research findings support the use of cognitive interventions to aid motor learning and development, since cognitive processes are considered a fundamental aspect of motor skill acquisition. However, short term cognitive interventions for motor learning have not been attempted with preschool-aged children before. Would such applications fit with current theories of education, and are there ways to make this practical?

The next topic reviewed relates to educational theories which support teaching practices aimed just above the child's level of independent ability or performance. Constructivism is referred to, and followed by a short explanation of Vygotsky's (1978) social-historical theory of cognitive development. The reader discovers that his educational theory is practical and has been applied with children with Ds in limited ways. However, Vygotsky's theory has not been applied to the psychomotor domain. Is it possible to apply his principles to that domain? Could one determine what teaching practices make a difference for a child, and, would it be possible to determine a child's potential to learn a motor

skill? If so, how could one accomplish this?

Dynamic assessment is introduced as a unique form of assessment. This is a collaborative test-teach-test procedure which explores the instructional techniques and psychological processes involved in learning and development. Typically applied to the cognitive domain, a detailed description of one type of dynamic assessment, the "graduated prompt" (GP) format, follows.

Next, the value of using dynamic assessment and GPs in the psychomotor domain is presented. One finds that this is relatively unknown in the field -- even though authors suggest that there is a real need to develop new ways to assess knowledge of the product and processes involved in motor learning and development! But, could one really use cognitive strategies to teach motor skills, and how would that be done? How does one assess cognitive knowledge of a motor skill? Could and how would children with Ds display their knowledge of psychomotor concepts?

A short description details the lack of tools and other assessments which measure a child's understanding of psychomotor knowledge and concepts. Information presented suggests typical ways in which cognitive knowledge is currently measured -- but none of this applies directly to gross motor skills or abilities. Gardner (1993) challenges and invites people to use new ways to assess learners and measure children's cognitive abilities. He suggests that people working in different fields may want to devise and use more inter-disciplinary and open ended forms of assessment, and that they should also offer different opportunities through which children can display their knowledge of events or ideas. Next, suggestions are made about how one might create new assessment tools which may be able to examine knowledge and ability in the psychomotor domain for preschool aged children with Ds.

This chapter ends with a summary that weaves knowledge about Ds, the practices and theories related to motor learning and development with various educational approaches, support for trying new ways to teach psychomotor skills, and the challenge to create new ways to assess children's knowledge of the psychomotor domain. The assumptions and challenges related to studying this topic are described, and finally, the focus of the case study and the research questions are presented.

Background Information Related to the Problem

About Down Syndrome

Duncan and Down first noted and described several features of a genetic condition in 1866. This was later named "Down syndrome", after John Langdon Down who documented the classic characteristics (Coleman, 1988; Cunningham, 1988; Eichstaedt & Lavay, 1992; Pueschel, 1978a; Rynders, 1987a). Research done by Lejeune in 1959 verified the scientific basis for the syndrome -- an additional chromosome in the cells of the body.

Volumes of literature describe numerous aspects of and information about Ds. For example, the various types of Ds, the probability of giving birth to a child with Ds, the life expectancy and medical conditions, the characteristics and incidence of Ds, ways to educate people with Ds, and findings of research projects are all well documented (Baird & Sadovnick, 1989; Bird & Buckley, 1994; Block, 1991; 1994; Cicchetti & Beeghly, 1990b; Cunningham, 1988; de Graaf, 1995; 1998; Dmitriev & Oelwein, 1988; Eichstaedt & Lavay, 1992, Holmes, 1987; Huether, 1987; Jagiello, Fang, Ducayen & Sung, 1987; Korenberg, Pulst, & Gerwehr,1992; NICHCY, 1992; Pueschel, 1978; 1984; Pueschel, Tingey, Rynders, Crocker, & Crutcher, 1987; Sherrill, 1993; Stoll, Alembik, Dott, & Roth, 1990; Thuline, 1987; Tingey, 1988a; Walsh, 1995).

The chromosome anomaly commonly known as Ds, typically results in developmental delays and other conditions which impact the cognitive, affective, and psychomotor domains throughout the lifespan. Again, extensive amounts of literature document these delays, including those related specifically to psychomotor development (Block, 1991; Carr, 1970; Cicchetti & Beeghly, 1990b; Chumlea & Cronk, 1981; de Graaf, 1995; Dmitriev & Oelwein, 1988; Dunst, 1990; Eigsti, Aretz, & Shannon, 1990; Elliott, 1990; Harris, 1981, 1884; Hartley, 1986; Johnson-Martin, Jens, & Attermeir, 1986; Lauteslager, 1995; Pueschel, 1984; Pueschel et al., 1987; Rodgers & Henson Lee, 1989; Tingey, Mortensen, Matheson, & Doret, 1991; Van Dyke, Mattheis, Schoon-Eberly, & Williams, 1995; Vermeer, 1995).

Studies involving gross motor skill development in people with Ds reveal different results. For example, although the sequence of motor development

was reported to be similar to non-handicapped peers, and motor development is fairly normal for the first six months of life, it then declines steadily. Hypotonia is considered the main factor in reduced motor skill ability. There are wide variations in the rate of motor development; there is an overall delay in the acquisition of gross and fine motor skills, but fine motor skills tend to be acquired before gross motor skills; and children with Ds perform, score significantly lower, and develop motor skills and abilities more slowly than others without Ds. Research findings also show that the motor skill levels of children with Ds are representative of the average abilities of children without Ds at a younger age, and that children with Ds frequently exhibit unique movements and locomotion sequences and patterns. As motor skills are attained, the child with Ds typically falls progressively further behind their non-handicapped peers, the gap widens steadily, and a general deceleration in psychomotor skills is reported as they increase in age (Block, 1991; Connolly & Michael, 1986; de Graaf, 1995; Dyer, Gunn, Rauh, & Berry, 1990; Fishler, Share, & Koch, 1964; Harris, 1981, 1984; Henderson, Morris, & Ray, 1981; Niman-Reed & Sleight, 1988; Winders, 1997; Zausmer & Shea, 1984).

It is also very interesting to note that several studies report children with Ds are more motorically delayed than cognitively delayed in their development. For example, among other findings, Carr (1970) found that when 47 children with Ds were compared to a control group of children without Ds (n=39), the scores of children with Ds, assessed by the Bayley Infant Scales of Mental and Motor Development, were significantly lower than scores of the control group as early as six weeks of age, and this trend continued for several years. In addition, after six months of age, the motor scores declined more than mental scores.

LaVeck and LaVeck (1977) used the Bayley Scales of Infant Development (BSID) to assess and compare 60 non-Ds children with 40 children with Ds. The children tested were between 12 to 36 months, and in all cases, "the mean mental quotients were significantly higher than mean motor quotients...$p<0.01$" (p. 768). These findings were substantiated by Schnell (1984) with 89 children who were investigated for growth and developmental patterns up to the age of three years. Using the BSID, Schnell reported a linear pattern of development in the child's mental scale and a pattern of deceleration in the motor scale.

Connolly, Morgan, and Russell (1984) also investigated intelligence and social quotients and compared them with the motor abilities of children with Ds aged 7.3 to 10.3 years of age. The overall regression in motor skills was evident even at that age. Motor abilities were more delayed than the other quotients, and gross motor abilities lagged behind fine motor abilities.

Types and Effects of Current Programs of Intervention

As a result of the findings that children with Ds are delayed in numerous aspects of their development, many long-term early intervention programs were initiated within the last 25 years. Influenced by Gesell and Amatruda (1941), Chaney and Kephart (1968), and Ayres and Getman, the focus of such interventions are based on neuro-developmental and sensory integrative approaches and is generally aimed at helping the child gain gross motor skills such as rolling, sitting, crawling, and walking (Harris, 1981, 1984; Henderson, 1985; Kelso & Price, 1988; Niman-Reed & Sleight, 1988; Winders, 1997; Zausmer, 1978a, 1978b, 1990; Zausmer & Shea, 1984). Highly organized programs were developed and gross motor exercises implemented by specialists on infants and young children with Ds. Motor skills are traditionally deconstructed through task analysis into smaller sub skills, and therapists focus on developing proper coordination, sequencing, and correcting muscular activity. In practice, treatment includes having the therapist or parent prop the child in certain positions, physically guide the child through predetermined movement activities, or practice and repeat specific motor skills with the child as frequently as possible (Kelso & Price, 1988; Niman-Reed & Sleight, 1988; Winders, 1997; Zausmer, 1990; Zausmer & Shea, 1984). However, not all people believe that these are the best ways to teach motor skills.

Haywood (1986) writes that "passive movements (as with adults manipulating infants) are not neurologically controlled in the same manner as movement actively undertaken by the infant" (p. 93). This is also reinforced by Keogh and Sugden (1985) and Schmidt (1991) who report that if interventions are passive or artificially manipulated, children are actually receiving less data about movement because only certain sensory receptors are functioning and little, if any motor information is available.

Forest (1981) comments that children, those with disabilities in particular, need to be active rather than passive participants in programs. Gerber (1987b) supports this, and cites Dr. Emmi Pikler, a motor development specialist, who opposes any practice implemented on young children which props them into certain positions and uses compulsory strategies to stimulate motor development. Pikler postulates that such practices not only negatively "affect motor development, but they influence all other areas of growth - social - emotional - cognitive and even character formation" (Gerber, p. 54). Eisner (1982) also writes that by neglecting the simultaneous involvement of various domains in learning and developmental processes, reduced competencies in other domains of behaviour may result.

There are many other people who also comment on the negative effects of passive adult-controlled treatments and therapies. They suggest that possible effects of such long term interventions may be evidenced in multiple domains, that this form of intervention actually impedes learning, and that if the child begins participating in programs as passive players, the ramifications over time may be incalculable (Berk & Winsler, 1995; Brandow, 1995; Braun, 1993; Cratty, 1973b; Eichstaedt & Lavay, 1992; Feuerstein, Rand, & Hoffman, 1979; Fowler, 1981; Gerber, 1981, 1987a, 1987c; Holt, 1995; Jobling, 1996; Keogh & Sugden, 1985; LeBlanc & Dickson, 1996; Lovett, 1996; Pikler, 1987b; Rankin, 1997; Schmidt, 1991; Schwebel & Raph, 1973; Westenberg, 1997; Widerstrom, Mowder, & Sandal, 1991).

So, although children are led through prescribed physical exercises in hopes that these activities will facilitate the development of motor skills by stimulating neuro-developmental structures, and volumes of literature suggest otherwise, parents of children with Ds are informed that the strategies currently used by practitioners and implemented on their infants and preschoolers, will supposedly reduce deficits in the child and eventually facilitate the performance of motor milestones. Parents are often advised that current forms of motor development programming will facilitate development in other areas as well. Speech, emotional and social skills, self-help skills, and perceptual and cognitive abilities, are all said to improve as a result of motor skill development (Bailey & Wolery, 1984; Bird & Buckley, 1994; Chaney & Kephart, 1968;

Cicchetti & Beeghly, 1990b; Cratty, 1973a; Haywood, 1986; Niman-Reed & Sleight, 1988). Yet, even though such claims are made about the value of participating in gross motor programs, the strange reality is that gross motor development programs cease for children with Ds around the age of two years (Tingey, 1988b) and there is little effort placed on facilitating the acquisition of additional gross motor skills after that time! This is unfortunate since the foundation for all movement skills are learned in the first six years of life and the need for movement is an integral part of human nature (Benelli & Yongue, 1995; Brandow, 1996; Burton & Miller, 1998; Decker, 1988; Haywood, 1986; Sanders, 1992; Wickstrom, 1983; Winnick, 1979, 1990).

Since there is a lack of motor skill programs for children between the ages of 30 to 66 months of age, there is also very little research about motor learning and development in preschoolers with Ds. This creates a large gap in the knowledge base and is distressing because it is during these early formal educational years that efforts should focus on how to facilitate learning and development in all domains in young children (Casto, 1988). For children with Ds, older than 30 months of age, the "evidence of educational achievement is meager in the age period in which education is often regarded as most important" (Rynders, 1987b, p. 147).

Fortunately, several research projects have been conducted on infants and children with Ds under the age of three years which center on the development of motor skills (Connolly et al., 1984; Connolly, Morgan, Russell, & Richardson, 1980; Eigsti et al., 1990; Harris, 1981; Henderson, 1985; Zausmer & Shea, 1984). Most of these developed as segregated programs, which focused on individual content areas, because people were told that children with Ds need "specialized teaching strategies" that are domain specific. The skill specific focus remains the current practice and appears to be an internationally accepted solution (Bird & Buckley, 1994; de Graaf, 1998; Dmitriev & Oelwein, 1988; Dyer et al., 1990; Kelso & Price, 1988; The Canadian Down Syndrome Society (CDSS), Ups and Downs, & The PREP Program, 1996; Winders, 1997).

According to Gerber (1981), programs which focus on specific skills isolated from other domains result in interventions which become based on externally imposed curriculum. In such programs, little emphasis is placed on

gaining information about the exact teaching strategies that work best for individual children. Rather, children are placed into highly structured, adult-directed and adult-initiated programs complete with checklists, strict schedules, direct forms of instruction, reinforcement and modeling techniques, well-documented objectives, evaluation strategies, and other similar methods. Such strategies are believed to remediate or help these children acquire "deficient" or absent skills (Dmitriev & Oelwein, 1988; Oelwein, 1995, Watkinson & Wall, 1982). The developmental or behavioral philosophies behind such practices suggest that optimal acquisition of milestones in multiple domains can only be facilitated through an orderly and sequential "climb up" the child's developmental level. Some authors write that by "teaching" children this way, educators may actually interfere with learning processes (Breig-Allen & Dillon 1997; Malaguzzi, 1993b; Moran, 1997). In addition, it would appear that such forms of intervention do not purposefully invite or encourage the child to construct meaning and understanding about the skills they are gaining.

While some researchers report significant benefits in the motor development of infants as a result of long-term early intervention programs (Connolly et al., 1984; Connolly et al., 1980; Dmitriev, 1988a, 1988b; Eichstaedt & Lavay, 1992), others comment that such programs do not have lasting benefits. In extensive reviews, Block (1991), Casto (1988), de Graaf (1995) and Gibson and Fields (1984) write about the efficacy of early intervention programs for infants with Ds. They report some short term gains in intelligent quotients, motor, language, and academic skills, even though gains in self-concept, social competency, family and peer relationships are not evidenced. Unfortunately, only a few studies can show any effectiveness of programs after two years. De Graaf recognizes and comments that all domains are interconnected, even though programs address development in each domain separately and some areas are focused on before others. He is puzzled about the need to emphasize development in one domain prior to others, and wonders how one could best adapt future early intervention opportunities in terms of: intensity, method, and endurance; using parents in programming; and implementing an interdisciplinary approach within interventions for children with Ds. One solution to de Graaf's dilemma may be to use a theory which recognizes the value,

importance, and necessity of competent others (like teachers, parents, and / or peers) to co-construct new understandings with the child. Interdisciplinary connections may also be facilitated by using elements of other domains intentionally when presenting knowledge and instruction aimed to impact one specific area. While these suggestions may appease deGraaf's queries and concerns, one can only determine the efficacy of learning and development in multiple domains simultaneously by purposefully influencing multiple domain in an intervention, and then analyzing the results.

Although parents are still informed that brain or brain stem stimulation facilitated through early therapeutic interventions will result in more sensory integration which will lead to more complex adaptive responses, the lasting effects or permanent learning resulting from these forms of training are questionable. Interestingly, different theoretical perspectives are used to support the use of certain practices, and the scientific research to endorse these sensory, perceptual-motor, or behavioral techniques is weak and plagued with methodological problems (Bailey & Wolery, 1984; Block, 1991; Casto, 1988; de Graaf, 1995; Sherrill, 1993). Even those who developed theories or supported such approaches in the past, comment that the focus within these theories is too narrow (Knobloch, Stevens, & Malone, 1980).

Jobling (1996) summarizes the dilemma that children with Ds are in as a result of the "hodgepodge" of theoretical perspectives applied within long-term interventions. She writes that programs of skills training which children with Ds are typically placed in, "could be considered as 'instructional imprisonment;' while programs with no external intervention which just offer opportunities or experiences (a sort of 'osmosis' approach to learning) could be considered as 'mere entertainment'" (p. 240). These statements seem to send a message of: "Why bother with any form of intervention?" Obviously, there is room for improvement in the way one delivers educational programs for children with Ds! Other methods and theoretical perspectives may need to be tried.

Two different programs, the PREP and I CAN models, were developed and applied to meet the physical activity needs of children with Ds, or other developmental delays in the last 20 years. Both instructional models discuss the value of using various prompts when teaching gross motor skills to children, but the

teaching strategies used focus on the physical components of motor skill acquisition; no noticable attention is given to the use of cognitive strategies to teach motor skills. The PREP Program developed by Watkinson and Wall (1982) is an individualized instructional technique that uses a behavioristic approach with systematic "preresponse prompts and postresponse feedback" (p. 7); shaping, chaining, and fading techniques; and opportunities for motor skill practice in small groups. Teaching styles used in this physical education program include: verbal directions, physical prompts and assistance, and / or demonstrations in various combinations.

The I CAN Program was developed by Wessel (1976, 1980a), designed for use with a wide range of learners, and adapted later as the "Achievement Based Curriculum" (or A-B-C) by Wessel and Kelly (1986). This teaching model contains well-established goals and objectives, standardized assessment tools, instructions that focus on efficient teaching methods and time management techniques, and ways to evaluate the effectiveness of the program on students. Designed primarily as a instructional model for year long physical education classes, and considered a "diagnostic prescriptive teaching approach [which uses a] direct instructional model" (Wessel, 1980a, p. 45), the I CAN Program also includes components one can use with preschool-aged children (Wessel, 1980a). The I CAN program also focuses on the physical aspects of motor skill acquistion; suggests the use of verbal directives, demonstrations, opportunities for drill and practice, and organized game activities; and is frequently referred to in text books describing adapted physical activity programs (Auxter et al., 1993; Burton & Miller, 1998; Eichstaedt & Lavay, 1992; Sherrill, 1993). The revised "A-B-C" curriculum guideline (Wessel & Kelly, 1986) reports that corrective procedures and appropriate instructional activities must be used with students with learning difficulties, and even gives general suggestions for varying instructional strategies (pp. 63-65). However, no other details of what exact teaching strategies one should use are available. In addition, no published studies were found which refers to the efficacy of the I CAN or the PREP program with preschoolers with Ds.

To summarize, past versions and present forms of long-term intervention are very structured, use different theories to support practices, and focus on the

acquisition of specific skills which are treated in isolation. These formats accommodate the goal of establishing organized training techniques and practices of behaviour modification which have been used on people with developmental delays for the last thirty years (Baine, 1996; Block, 1994; Burton & Miller, 1998; Cratty, 1989; Davis & Burton, 1991; de Graaf, 1998; Lovett, 1996; Miller & Sullivan, 1982; Sherrill, 1993). Such teaching strategies do not appear to help an individual develop a cognitive understanding of the concepts involved in movement experiences. And, according to Eichstaedt and Lavay (1992), even though most practitioners currently utilize this form of training to promote motor skill acquisition, some are also "hesitant to accept these procedures [as the only way] to promote learning (Loovis, 1980; Presbie & Brown, 1977; Wehman, 1977)" (p. 110). So, even the people who typically use this form of training recognize that this is not the only way to teach motor skills! There must be other ways to influence psychomotor learning and development.

What does motor learning literature say about using other strategies to facilitate gains in physical movement? Is there any support for merging cognitive processes and physical behaviours, or any evidence suggesting that cognitive processes are a fundamental aspect of psychomotor ability?

The Blending of Cognitive Activity and Motor Behaviours

There is some evidence for the merging of cognitive processes in physical activity. For example, Gallahue and Ozmun (1995), who work in motor learning, recognize that elements of mind and body are active in all behaviours; writing,

> The cognitive domain as applied to the study of movement behavior involves the functional relationship between mind and body. The reciprocal interaction of mind and body has been explored by observers ranging from Socrates and Plato to the developmental theorists of the twentieth century (ie. Piaget). (p. 18)

Piaget's theory (1963) which states that early motor activities facilitates cognitive development is frequently endorsed and considered to be proof that the cognitive and motor domains are fused somehow. There is much less support for the perspective that cognitive processes may enhance psychomotor abilities. Researchers making the later claim refer to short / long term memory;

gains in "expert" behaviours, sports, and games; and better social, emotional, and psychological functioning in individuals. However, most research in these areas is done with adolescents or adults (Doll-Tepper, Dahms, Doll & von Selzam, 1990, Fitts & Posner, 1967; Goodman, Wilberg, & Franks, 1985; Rink, 1996; Rink, French, & Tjeerdsma, 1996; Seefeldt, 1993; Smoll, Magill, & Ash, 1988; Starkes & Allard, 1993; Zelaznik, 1996).

Magill (1993) and Rink, French, and Tjeerdsma (1996) argue that we must increase our understanding of how motor skills are acquired so we can help learners become more competent and proficient in motor skills and to gather evidence about the bond between motor and cognitive processes. Kerr (1982) also recognizes the importance of this topic. He writes, "the performance of motor skills involves more than just muscular activity" (p. 6), and explains that elements such as: how, why, when, where, how far to move, and any other factors which both guide and produce motor behaviour are important aspects related to learning and development in the psychomotor domain. There are others who provide evidence about the interrelationship of cognitive and physical abilities when acquiring motor skills (Eichstaedt & Lavay, 1992; Gallahue & Ozmun, 1995; Keogh & Sugden, 1985). Even Gardner (1993) provides verification about the linkages between physical and cognitive abilities. Not focusing specifically on motor skill acquisition, he writes, "The ability to use one's body to express an emotion..., to play a game,... or to create a new product...is evidence of the cognitive features of body usage" (p. 19).

Cratty too recognized and worked to gather evidence of the connections between the cognitive and psychomotor domains. A prolific writer (1967, 1970, 1971, 1973a, 1973b, 1974, 1975, 1986), he spent years researching how physical movement can enhance cognitive ability. He documented strategies that educators could use to facilitate learning and development in academic subjects. Regrettably though, Cratty did not spend much time and effort reversing this connection / benefit between the two domains. Yet, in a recent book (1989), he comments about the value of using cognitive strategies to impact the psychomotor domain. He writes that mental practice of motor skills are important before, during, and after movement experiences, and he also writes that cognitive information may be valuable especially during exposure to

new motor tasks and when working with children who may experience challenges in various domains. Cratty credits this rationale as coming from Mosston (1968, 1972) who believes that the three most important aspects of learning motor skills are: to encourage and engage the thought processes of learners during motor experiences; to facilitate learners to make their own decisions about the various aspects of the educational process; and to assist the transfer of decision making from the teacher to the learner in a progressive manner. Mosston believes that cognitive processes or "mediating behaviour" through which children are led, or allowed to focus on during motor experiences, are actually more important than the short term practical motor performance outcomes!

Clearly there are a few writers in the field of kinesiology and motor learning who support the blending of cognitive processes and motor behaviours. This is exactly what the term psychomotor implies. And, there are people researching topics that incorporate cognitive processes as a way to facilitate gains in the psychomotor domain (Rink, 1996; Starkes & Allard, 1993). But are there other disciplines which also explore these connections in a purposeful way?

As the name suggests, the field of educational psychology typically focuses on the psychological processes that occur in human learning and development, however the primary emphasis in this discipline is placed in the cognitive, affective, and communicative domains (Berk & Winsler, 1995; Bruner, 1978, 1987, 1990; Bruner & Haste, 1987; Connolly & Bruner, 1973; Eisert & Lamorey, 1996; Eisner, 1982; Elias & Tobias, 1996; Flavell, 1965; Hart, Kolberg, & Wertsch, 1987; Hendrick, 1997; Nicolopolou, 1993, Piaget, 1962, 1963; Rankin, 1997; Rogoff, 1993; Schwebel & Raph, 1973; Vygotsky, 1978). Except for Piaget (1962; 1963) who identifies motor behaviours as a means to develop cognitive ability, there is little to no emphasis on the interconnectedness between the cognitive and psychomotor domain. In essence, scholars have replaced the formerly included psychomotor domain with the communication realm and thereby omit any focus on behaviours related to physical movement.

It is distressing to note this general lack of recognition or interest in the psychomotor domain, since all children have natural inclinations to move and explore, it is vital for education and development, and movement provides

countless benefits which range from the physiological to the psychological end of the continuum (Benelli & Yongue, 1995; Brandow, 1995; Chaney & Kephart, 1968; Cratty, 1967, 1973a; Gerber, 1987b; Fowler, 1981; Hartley, Frank & Goldenson; 1952; Haywood, 1986; Kelso & Price, 1988; Pikler, 1987a; Sanders, 1992; Sherrill, 1993; Stinson, 1988; Winnick, 1979, 1990). Riggs (1988) summarizes the necessity of providing movement opportunities for all children; "Movement is a universal, full-time, personal, childhood occupation, and it's importance in children's early learning cannot be overemphasized" (p. 17).

Researchers and practitioners must not give up trying to facilitate learning and development in the psychomotor domain, especially for children with Ds. For example, Zausmer and Shea (1984) write that it is important to continue with such interventions because, if

> one takes into account the impact of motor activities and motor skills on almost all aspects of human development and their influence on social and vocational adjustment throughout one's life, the need for continued investigations related to the acquisition of motor proficiency for analysis of performance patterns and effective methods of training children with Ds cannot be overemphasized. (p.144)

Oelwein (1988c) also notes research and interventions must not be stopped. She and Fewell (1988) write continued intervention must occur for maximum benefits, since "failure to continue motor programming or therapy can result in a decrease in the rate of motor development" (Oelwein, p.147). It may simply be that people have attempted to improve motor skills and abilities in young people with Ds using the wrong theories and forms of intervention as their basis.

Fortunately, many references do recognize that children develop intellectually, physically, socially, and emotionally, and all areas are interconnected and interdependent (Block, 1991; Hanson, 1988; Haywood, 1986; Kirchner & Fishburne, 1998; Love, 1988; Mosston & Ashworth, 1994; Rink, French, & Graham, 1996; Sherrill, 1993; Shore, 1997; Stewart, 1990; Stinson, 1988; Wall, 1990; Widerstrom et al., 1991; Winnick, 1979). Bushner (1988) writes that because of their interconnectedness "effective teaching and learning must activate all three domains of learning (cognitive, affective, psychomotor)" (p. 53).

Within the field of physical education there are also some references which discuss the need for interventions which blend cognitive and physical elements

to facilitate motor skill acquisition (Burton & Miller, 1998; Bushner, 1988; Gallahue & Ozmun, 1995, Haywood, 1986; Magill, 1993; Mosston & Ashworth, 1994; Sugden & Keogh, 1990). Cratty (1973a) writes that motor skill production involves mental processes from planning through to the completed execution of a task, and therefore intellectual functions and cognitive operations must be paired with movement experiences in purposeful ways, since, "mindlessly applied and mindlessly accepted motor tasks are not likely to change anything but motor function" (p. 6). Spaeth Arnold (1981) states that when teaching motor skills, competent people must "help students 'learn how to learn', and....facilitate an active process of seeking successful solutions to relevant motor problems by matching movements to the characteristics of the performance environment" (p. 79-80). Rink, French, and Tjeerdsma (1996) cite Thorpe, Bunker, and Almond (1986) as individuals who boldly claim that teachers should help students develop an appreciation and understanding of games and sports before learning the physical skills required. Hogg (1986) explains that motor competence involves several "layers" of motor and cognitive activity, and therefore both aspects are necessary prerequisites for goal directed activity. Mosston and Ashworth (1994) also recognize the value of using cognitive strategies to influence motor learning. And, even though it was not the original intent, Feuerstein, Rand, Hoffman, and Miller (1980) report after working with a 14 year old boy who was neglected, illiterate, and displayed cognitive dysfunctioning, his "first signs of modifiability occurred in the realm of perceptual motor behavior" (p. 64). In addition, Block's (1991) comments relate directly to this research project. He states that social and cognitive abilities directly influence the motor development of children with Ds (p. 204).

Fortunately, a few motor learning and development theorists also recognize the value of including cognitive processes in motor learning. Following is a description of the main theoretical approaches of motor skill acquisition. Where cognitive processes are included in the ideas, they will be presented.

Neurophysiological or Neuropsychological Approaches

Much research has been conducted which seeks to understand the biological systems involved in aspects of human behaviour. Study includes

research about blood flow, structures, and activity of the brain, the central nervous system (CNS), the sensory receptors, and how cognitive control impacts muscle action and function (Bernstein, 1967; Bullock, Grossberg, & Guenther, 1996; Klapp, 1996; Worringham, et al., 1996; Shore, 1997; Zelaznik, 1996). Although biological foundations are an important aspect of motor control, they will not be presented here since this project seeks to discover aspects related to learning motor skills rather than determining how motor control occurs in the neuro-anatomy. Nevertheless, Elliott (1990) and others (Elliott, Weeks, & Gray, 1990; Elliott & Weeks, 1993) have conducted research in this area with adults with Ds. Elliott and his colleagues investigated hemisphere specialization related to movement control and found that people with Ds "have syndrome -specific differences in brain organization" (1990; p. 203). They also report that people with Ds respond faster to visual sequencing tasks than verbal sequencing tasks, and that such deficits are due to a biological dissociation between different areas of the brain.

The Information Processing / Mechanical Engineering Approach

This approach is based on a "man as machine" servo-mechanism analogy, in which self-regulating devices in the organism determine future performances. People adopting this approach believe motor activity is governed by a control center, or "executive". This generates and issues movement commands to muscles and bones of the body, or "effectors". Sensory information or stimulation is received as "input" and "encoded" into patterns of neural energy in the CNS. When triggered, a motor program housed in the CNS, implements a motor response, resulting in motor action or "output". Feedback and knowledge of results are critical components of this approach since it is believed that continual practice with appropriate feedback results in desired motor actions (Adams, 1971; Anson, 1977; Chec & Martin, 1995; Magill, 1993; Poretta, 1981; Robb, 1972; Schmidt, 1975, 1991; Shea et al. 1993; Swinnen, 1996).

In 1971, Adams developed a Closed-loop theory in which he proposes two forms of recall are responsible for motor performance. He believes a "perceptual trace" is left in the CNS after every motor performance, and over time, correct traces are strengthened, creating a "motor program". A "memory

trace" selects and initiates the program. Output is fed back, compared to the perceptual trace, and, if necessary, updates the motor program. So, movement is activated, feed-back detects errors in programs, and alterations are made -- producing a closed loop.

Schmidt (1975, 1991) debated Adam's ideas and supports an Open-loop theory. He believes motor programs can be implemented without feedback, since certain skills occur too quickly for feedback to be useful and performers sometimes alter planned motor skills spontaneously. Schmidt also developed a Schema theory which focuses on motor control. He proposes that individuals create general schemas of motor skills rather than storing memory traces for each motor skill. For example, by abstracting common aspects of a motor skill such as throwing, a general "throwing schema" is produced and stored in a motor program. When and if a new variation of throwing is required, information encapsulated in the throwing schema can be applied to the novel task. He believes certain information is considered before movements are implemented and other data is acquired after movement completion. Schmidt also theorizes knowledge of performance / results serves several functions -- as an evaluation tool, correcting errors in the motor program, and a way in which learning occurs.

Schmidt (1975, 1991) claims that his theory explains how already proficient athletes can improve their skills. Children are seldom included in theoretical discussions, even less in practical applications, and he offers no explanation about how information processing abilities arise during childhood. He states that early motor patterns are the result of innate developmental progressions and he never addresses how children gain meaning and understanding of psychomotor skills and abilities. Nonetheless, Schmidt's resources are full of useful information related to this research project -- various practice conditions and intervention techniques which one may apply to help others acquire motor skills. For example, he reports that learners need to know "what to do" and "how to do" certain motor skills. He notes that to facilitate learning, other people need to be involved in the initial phases of gross motor skill acquisition. He reports that individuals need to be given knowledge of results by a competent other, and if a learner is able to see or visualize their personal performances, there are usually great improvements in motor performance. This suggests that visual

representations of children's movements will facilitate knowledge and understanding of how movement occurs and what it looks like. Schmidt writes that competent others need to be willing to give knowledge of results many times, for this eventually enables the development of internal error detection mechanisms. Schmidt's (1991) suggestions imply that information given through social interactions, such as exchanges between coaches and athletes transforms into internal knowledge and eventually learners can determine errors on their own! This seems to follow Vygotsky's (1978) ideas of the transfer of knowledge from an interpsychological plane to the intrapsychological plane, and is also supported by Leas and Chi (1993).

Schmidt (1991) also writes that learners should always be provided with an opportunity for mental practice as well as for movement experiences. While it was first believed that overt physical activity was necessary for motor learning to occur, it is now understood that mental practice actually generates motor learning and "randomly alternating mental practice with physical practice, rather than giving [physical activity] in a blocked fashion, is even more effective for learning (Gabriele, Hall, & Lee, 1989)" (p. 184). Schmidt refers to many other studies which support this unique aspect of learning motor skills and concludes, "There is no doubt...that some combination of mental practice and physical practice is more effective than either alone, and the clever instructor will find ways to intertwine the two practice modes for maximal gains" (p. 188). He adds that the benefits of mental practice may be due to the fact that

> mental practice utilizes the strategies and verbal activities that are known to be part of the task in the early stages. By practicing mentally, one can establish appropriate strategies, review the efforts on previous trials, think about possible errors and how to correct them, and so on; it is little wonder that this kind of activity is beneficial to early performance. (1975; pp. 82-83)

So, it appears that Schmidt believes cognitive process are involved in the planning of motor responses. Others, such as Fitts and Posner (1967) who support the man as machine model of motor learning, also seem to recognize the value of utilizing cognitive interventions to influence motor skill performance.

Fitts and Posner (1967) developed a theory which suggests that three phases are involved in the learning of a motor task. The initial step, known as

the "learning, verbal, or cognitive" phase, involves as much thinking about the task as performing it. This stage uses reasoning to anticipate or solve a motor problem and the focus is on which movement[s] one is to make rather than how to do it effectively or efficiently. Fitts and Posner suggest that specific directions given by a teacher and then followed by some experimentation, may accelerate this process. However, they also comment that self-talk or gradual assistance by others may facilitate learning in this phase as well.

The second stage, named the "intermediate, associative, or motor" phase, reveals a gradual shift from concentrated thinking, to focused movement efforts, to the refining of a particular motor skill. Self-talk may become less frequent during this stage, but learners still need a mental plan of the motor skill to be performed and appropriate feedback so that practice sessions are meaningful.

The final stage is considered the "automatic" phase. During this stage, movement becomes habitual, one does not need to concentrate mentally on the task being performed, and motor performances are carried out independently. Applying this theory in practical ways, a teacher or other capable individual would assist and guide learning in phase one and two, but by stage three, the child would demonstrate self-governing motor behaviours.

Related to Fitts and Posner's model, which integrates cognitive processes in psychomotor performances, Fleischman (1965) contends all motor tasks have underlying cognitive and motor abilities, and that these are divided into "abilities" and "skills". Abilities relate to the general underlying biological characteristics of a person, while skills are more task specific. Fleischman also claims that initial performances rely heavily on cognitive abilities, but over time, and with practice, performance is based more specifically on motor abilities. Based on a factor analysis of 300 adults who performed 100 tasks, Fleischman believed ten main movement characteristics or abilities existed within a person. Called "Fleischman's Motor Abilities Hypothesis", he clustered related skills into various groups and theorized that this indicated some type of genetic ability.

Even though Fitts and Posner (1967) and Fleischman's (1965) ideas are part of larger information processing models, some concepts seem to support a socio-constructivist approach to learning and development. It is fascinating that their ideas relate to skill acquisition in the psychomotor domain, an area not

normally considered in literature related to socio-constructivst theory. Collectively, Fitts and Posner and Fleischman believe that learning precedes development; mental practice, reflection, and meaningful feedback are all valuable for construction of knowledge; learners should consider using self-talk during initial phases; teachers or competent others may offer assistance or guidance within the learning process; and by progressing through Fitts and Posner's three stages, "inter-personal motor" processes eventually become "intra-personal motor" action and knowledge.

Others utilize a much different theoretical perspective in their explanation of motor learning and attempt to influence motor learning and development using very strategic and systematic interventions.

Neurodevelopmental, Sensory Integration, and Perceptual Motor Approaches

People working in this area generally believe development of behaviour is an innate maturational process dependent on the CNS; a process rooted in brain, sensory, and motor systems; and an orderly process which represents genetic endowment. Problems in motor development are considered to be the result of difficulties or delays at reflex and reaction levels; in the control of postural, laterality, and directionality; and the ability to utilize sensory information. Neurodevelopmentalists believe motor development problems can be rectified using sensory integrative or other related therapies aimed at the subcortical level of the brain, whereas perceptual-motor interventions are aimed at the cortical level of the brain. Together, they believe various therapies or instructional techniques stimulate brain function, which will result in positive overall gains in human performance -- one of which is proper sequential motor development. These beliefs remain the underlying principles within the field of physiotherapy and occupational therapy, are described in many resources, and are practiced yet today with young children with Ds or other developmental delays (Bailey & Wolery, 1984; Chaney & Kephart, 1968; Chaney & Miles, 1974; Chec & Martin, 1995; Connolly et al., 1980; Copeland, Ford, & Solon, 1978; Cox, 1996; Eisert & Lamorey, 1996; Fishler et al., 1964; Hanft, Posatery Burke, Swenson-Miller, 1996; Hanson, 1987, 1988; Harris, 1981, 1984; Henderson, 1985; Humphrey & Sullivan, 1973; Glover, 1989; Kelso & Price, 1988;

McCollum & Stayton, 1996; McEwan & Shelden, 1996; Moran & Kalakian, 1977; Niman-Reed & Sleight, 1988; Pueschel, 1984; Sherrill, 1993; Widerstrom et al., 1991; Winders, 1997; Zausmer, 1978a, 1978b; Zausmer & Shea, 1984).

Recently a new model, the Ecological Task Analysis approach has been developed as part of this thinking (Burton & Miller, 1998; Davis & van Emmerick, 1995; Sherrill, 1993). Individuals writing about this suggest that by manipulating single or various combinations of tasks, environmental factors, or performer dimensions, one may "gain insight into the dynamics of the movement behavior of students, provide teachers with clues for developing instructional strategies, and ultimately promote the success of students in performing the task" (Davis & Burton, 1991; p. 160). Unfortunately, none of the variables listed in the references consider how social interactions and cognitive forms of intervention may facilitate motor skill acquisition. In addition, this perspective does not fit clearly under this motor learning category since it seems to blend aspects of the perceptual motor theorists with the dynamic systems approach.

The Dynamic Systems Approach or Ecological View

This approach is gaining favor as a theory of motor behaviour. People working within this perspective believe movement is regulated not only by the brain or CNS, but other internal and external properties which work in a transactional nature to accomplish motor tasks. The "inner surround" includes physiological, psychological, and neuromotor systems, and the "outer surround" involves the physical and social environment (Keogh & Sugden, 1985). Physical actions are thought to be the result of complex relationships between the task, performer, and environment, and the environment and individual can change each other. Movement is not represented as a central program, plan, or schema, but emerges as a dynamic response of functional muscle groups to the environment. The muscle, bones, and joints act as functional collectives, are referred to as "coordinative structures" or action units, and are developed through prior practice or experience. Each coordinative structure is self organized by a desire to initiate action and integrate information from the environment without cognitive mediation (Magill 1993; p. 417), they self-correct, and are organized as single units that work in a way similar to a mass-spring.

Sugden and Keogh (1990) also state that information perceived by individuals from the environment, needs no elaboration; it is perceived directly and simply serves to facilitate motor actions and responses that are relevant to the individual. These descriptions imply that people respond to environmental factors with a spontaneous motor response. The environment offers constraints (challenges) or affordances (opportunities) for movement, but performers do not all react to the environment the same way (Bernstein, 1967; Block, 1991, 1994; Burton & Miller, 1998; Chec & Martin, 1995; French, Werner, Rink, Taylor, & Hussey, 1996; Gallahue & Ozmun, 1995; Kerr, 1982; Kim, McMillan, & Zelaznik, 1996; Kirchner & Fishburne, 1998; Kelso, 1982; Kugler, Kelso, & Turvey, 1982; Kugler & Turvey, 1982; Magill, 1993; Rosenbaum, 1991; Schmidt & Fitzpatrick, 1996; Shea, Shebilske, & Worchel, 1993; Sherrill, 1993; Wallace, 1996).

This complicated perspective may explain how well-practiced and automatic natural responses occur without advanced planning, but seems unable to describe how new motor behaviours are acquired, or, exactly how transactions between the task, performer, and environment occur. Even definitions of learning are unclear within the dynamic systems approach; VanSant (1995) claims motor behaviours are not changed due to learning (p. 62), Abernathy and Sparrow (1992) state learning is an "increased attunement to essential invariants and control over context-conditioned variability" (p. 29), while Wallace (1996) refers to learning as "a pattern formation process, in which the learner acquires new coordination patterns on the background of already existing patterns" (p. 186). Keogh & Sugden (1985) add that early motor learning and control is simply related to biological systems, development, sensory-perceptual functioning, and information processing; only as the child increases in age, do the personal-social factors influence movement interactions with the environment.

Another model incorporating aspects of the environment was developed by Gentile (1972). She suggests that motor skills can be categorized according to closed or open skills, or on a continuum between the two. Closed skills occur in a standard way each time the motor skill is executed and open skills take place in a constantly changing environment. In addition, Gentile also applies the concept of open and closed skills to individual motor tasks.

Similar to Fitts and Posner (1967), Gentile (1972) also proposes a stage model for learning motor skills. She proposes two stages, and writes the goal of the first stage is "getting the idea of the movement", or collecting relevant information via mental processes. She feels the learner must first understand the general concept or goal of the motor skill; this is done by establishing what is the relevant and non-relevant stimuli, establishing the most appropriate movement pattern, and then coordinating the limbs appropriately. Her second stage is identified as the fixation / diversification stage and focuses primarily on various conditions of practice that will facilitate skill acquisition. In essence, the learner must develop the capability required to perform the skill and then increase the consistency of achieving the required goal of the skill. While not clearly stated in this model, one supposes that information presented by competent others would be necessary during Gentile's initial stage, and that this would involve significant cognitive processing in order to alter the person's knowledge structure of a motor skill.

Some of the models and theoretical perspectives related to motor learning and control described above refer to cognitive processes or brain related activity involved in motor skill acquisition. Unfortunately, in applications of the theories and models just referred to, one rarely reads that cognitive understanding of motor skills is a goal of intervention, or, finds how it is evidenced or measured. Nevertheless, other evidence related to this research project was discovered in the literature but did not fit within one of the four theoretical approaches previously mentioned. Therefore, relevant information is presented as another possible approach to motor learning.

Cognitive Approaches

Numerous references support the various aspects of cognition involved in motor skill acquisition, although they use different terms to explain this. Wall (1990) writes that two types of knowledge are considered to be of great importance in motor skill acquisition; (1) declarative knowledge, which includes cognitive decision making components, specific sport knowledge, and other factual information about action which can influence the development and execution of a skilled action; and (2) procedural knowledge, which involves the

execution and muscle control related to motor behaviours, the "doing" aspect of movement. Other than Wall's citation of Bouffard (1986), the review of literature did not result in any published research which purposely used cognitive strategies or declarative knowledge to teach motor skills when working with people with cognitive delay. Wall cites Bouffard who looked at the knowledge base in mentally handicapped students when asked to solve a table tennis situation. Bouffard found that subjects who had declarative knowledge about where the ball would land, did move closer to the path of the ball before trying to hit it back, however, their ability to hit the ball back properly and consistently was still poor. Therefore, Bouffard inferred that one must have declarative knowledge and procedural knowledge in order to make a difference in motor behaviours. Wall supports this, writing "Conceptual knowledge alone will not necessarily improve motor performance unless the response aspects of an action are sufficiently proceduralized" (p. 48).

Many others, all contributors in Starkes and Allard's (1993) book titled *Cognitive issues in motor expertise*, recognize that "knowledge-cognition is vital in real world skilled motor performance. Knowledge is important for formulating the intended goals of actions; as well, knowledge facilitates actual performance" (Allard, 1993; p. 31). As the name suggests, most articles in Starkes and Allard's book report on comparisons of experts and novices in various sporting activities and / or other fields where motor skill and dexterity are necessary. For example, Baba (1993) reports on the results of a video game study in which four groups consisting of four people per group, were monitored over 50 games to see how various training procedures influenced the rates of performance improvements and the effects on basic performance. One group had movement training only (procedural knowledge), another had strategy training only (declarative knowledge), one group had both movement and strategy training, and one group served as a control. Baba writes that the movement training group showed early benefits, but these gains were short lived. She also reports that there was a large benefit of having the game knowledge before motor performance was required, and, both groups with strategy training "clearly improved their performance at a faster rate and attained significantly higher performance levels after 50 games than the Movement and Control groups" (p.

68). Baba writes that declarative knowledge about a skill may be more dominant than being able to perform the movements required when learning new motor skills, however, people still need to have "adequate movement skill to execute the strategy effectively" (p. 70). She concludes, that for experts, "Skill specificity is found in both the cognitive aspects (game knowledge) and motor aspects (movement skills) that contribute to game performance" (p. 70).

McPherson (1993) also claims that "motor and cognitive skills are closely linked as both skills are necessary when modeling skilled performance in sport" (p. 159). She refers to cognitive skills as "response selections" and motor skills as "response executions". She writes that there is limited theory and information about how one elicits and assesses cognitive responses related to motor skills. However, she adds that knowledge or cognitive representations themselves may influence procedural knowledge.

Likewise, French and Nevett (1993) discuss linkages between cognition and motor performances in typically developing children. They report that most children entering youth sports are considered novices because they possess minimal declarative and procedural knowledge about those activities. In addition, young children are not as efficient in labeling things properly, and this seems to impact their correct recall of movements when they are trying to learn and develop motor skills. To enhance psychomotor abilities in children aged seven to thirteen years, French and Nevett suggest that teachers and coaches should provide adult-like organizational strategies for them to use: verbal labels which may help them organize information, opportunities to structure movement concepts and elements, and other methods to facilitate recall. As they age, children will begin spontaneous rehearsal and other mediational processes as part of motor learning. French and Nevett report, "verbal / cognitive strategies or control processes of working memory mediate young children's motor performance. When children are cued to use efficient strategies, their performance improves" (p. 257). This article supports the use of competent others to guide the motor learning processes of young children, by purposefully applying cognitive strategies using visual, verbal, and kinesthetic cues.

French and Nevett (1993) encourage scholars to develop procedures which "measure sport declarative knowledge, procedural sport knowledge,

sport specific skills, and the cognitive (decision making or response selection) and motor (execution of sport skills) components of actual game performance" (p. 263). They write, "more work is needed using similar protocols to determine how and what proceduralization processes are occurring as children learn various sports" (p. 266). They comment that because movement skill development occurs in childhood, it is important to measure aspects of motor acquisition such as changes in procedural knowledge and skill development, as this may "uncover changes in knowledge structures, the interaction of cognitive and motor processes, constraints on cognitive and motor performance, relations to improved performance, and instructional practices which facilitate performance" (p. 267). They state that any topic related to the understanding of declarative knowledge and procedural knowledge in sporting events and game situations is a valuable and fruitful area for research.

Allard, Deakin, Parker, and Rodgers (1993) write "that expert motor performance depends on the linking of the knowledge of what must be done at a particular point in time with an appropriate motor program" (p. 99). They, as well as others in Starkes and Allard's (1993) book, imply that cognitive knowledge must be available before participating in a motor activity. However, Allard et al. also found that doing can also facilitate knowing. In other words, "What you do influences what you know" (p. 101). Based on studies of skating and diving judges, and baseball players, coaches, and referees, they found that people who perform specific motor tasks themselves are in a better position to know and understand various aspects of those activities than those who only observe the motor activity. So the link between cognition and motor behaviours goes both ways, what you participate in influences what you know about a motor skill, and knowledge about a motor skill influences motor behaviours.

There are others who have also been able to show different components of a motor task -- the cognitive processes and the motor abilities. Magill (1993) and Thomas, French, Thomas, and Gallagher (1988) refer to an experiment, done by French and Thomas (1987) with eight to twelve year old children involved in youth basketball leagues for a full season of practices and games. Magill writes,

the children in the basketball programs demonstrated a greater increase in

> their cognitive knowledge than in their motor skills. In particular, the players learned what to do in certain basketball situations faster than they learned the motor skills required to carry out the actions. (p. 63)

French and Nevett (1993) report their findings from this study, writing, "Results substantiated two components of performance in basketball, a cognitive decision making component and a motor skill execution component" (p. 263). In one season of basketball play, researchers found knowledge of the sport and accuracy of game decisions (the cognitive components) increased over time, while motor skill performances of dribbling and shooting remained constant.

Another example related to cognitive processing and motor skill acquisition, supplied by Brown and Campione (1986), suggests that parents, teachers, and coaches should demonstrate and model concrete ways in which students can begin to monitor their own learning. They state that this can be accomplished best using methods that individual students can easily understand.

Rink (1996) and Rink, French, and Tjeerdsma (1996) introduce the terms, "tactical awareness" and "skill", while commenting about the blending of cognitive understanding with physical abilities when teaching motor skills. They challenge the commonly held assumption that the best way to teach motor skills is to use a direct teaching format, and propose that to develop an understanding and appreciation of various motor skills may be a better goal for physical educators to focus on, rather than the skillfulness of physical movements. They state that this is based on the "Games for understanding approach" developed by Thorpe et al., (1986), which proposes that, "game appreciation and the development of tactical awareness should precede development of the motor skills of a game: Ideas related to 'what to do' should precede 'how to do it'" (p. 399-400). In a journal devoted to this topic, Rink (1996) reports results of studies which utilized this approach while teaching badminton to grade nine students. The studies are valuable since they use a purposeful attempt to influence the thought processes related to a particular activity during the teaching of a specific motor skill.

Rink, French, and Tjeerdsma (1996) state that the games for understanding approach to teaching games and sports

is particularly associated with a developmentalist constructivist orientation

> to learning and curriculum that emphasizes 'experiential learning' and 'discovery learning'....Under this umbrella, the individual student plays a major role in determining what is processed, how it is processed, and therefore how it is learned. (p. 400)

Although Rink (1996) only reports the application of the games for understanding approach with grade nine students, references were made to younger students in the review of literature provided by Rink, French, and Tjeerdsma (1996). Therefore, it seems reasonable to assume that this experiential or discovery approach may be applicable to younger children as well.

Mosston and Ashworth (1994) would support this. They wrote a book documenting various teaching styles that physical educators use when working with school-aged children. In it, they comment that cognitive processes are an important aspect of motor learning, but, they note that most teachers of physical education tend to use a "command and practice" (C&P) teaching style in which students are told and sometimes simply shown what to do, and then asked to repeat the skill until they develop a certain level of proficiency. Mosston and Ashworth write that this teaching method is part of the "reproduction cluster" which focuses on having students reproduce past knowledge, replicate models, and practice skills; it does not generally impact cognitive processes of learners. Based on Mosston and Ashworth's description of the various teaching styles, it appears that therapists and other practitioners use the C&P method with children with Ds in acquiring motor skills.

Mosston and Ashworth (1994) suggest that there are other methods to use when teaching gross motor skills to children. They report that teachers of physical activity should aim to actively create and facilitate cognitive connections in learners rather than have them simply reproduce information gained. To stimulate cognitive connections, Mosston and Ashworth recommend the "production cluster" of teaching styles, which encourage the production of new ideas and concepts for the learner and teacher. Although the information in Mosston and Ashworth's book is geared to physical education teachers of children aged six to 18 years of age, there are others who use similar ideas to help children, younger than six years, learn motor skills.

In a book on movement education for preschool aged children, Fowler

(1981) sums up the potential advantages of teaching motor skills in new ways. He writes that teachers should be willing to try new and different ideas rather than the traditional regimented exercises which are teacher-led and teacher-directed. He comments that the typical command style of teaching does "not produce or encourage any kind of thinking on the part of the child" (p. 8). Rather than formal methods of instruction with a direct approach to teaching and learning, Fowler writes that one should offer opportunities for

> thinking to take place, that is, discovering facts and principles, making comparisons or choices, solving problems and so on...to share in the decision making process...[these are] an important part of education for a student. Programs that fail to consider this function cannot be called successful in educating people, either in academics or in movement. (p. 37)

Fowler adds that children should not just imitate motor skills. They "need to acquire essential knowledge, skills, and attitudes relating to movement" (p. 44). "If, as teachers, we want to inculcate in children the quality of self-direction, self-discipline, and responsibility, along with the ability to make intelligent choices, we must provide the opportunities for these to develop" (p. 88). To do this, one must create learning opportunities just beyond their current level of functioning.

Cratty (1973) describes the importance of setting challenges for children which are just above their level of development. He writes that it is necessary to "expose children, whether normal or retarded, to a 'cluster' of tasks that offer both success and stress. If a child is provided only tasks that he finds easy to perform, he is not likely to grow either physically or intellectually" (p. 152). This is also supported by Vygotsky (1978) who comments that one way to see how learning and development can be facilitated, is to focus not only on what the child can do alone, but on what the child does with assistance. This way, instruction marches ahead of development, pulling it along, helping children to master new material, and move their minds forward.

So, by using cognitive interventions and focusing on skills just above the child's level of independent performance, it appears that certain teaching styles and strategies utilized by teachers, parents, or competent others, may have the capability to modify the psychomotor domain. Motor theorists and others also suggest that motor skill acquisition may be facilitated using cognitive processes

such as solving, reasoning, and inventing. If so, then this may be the style of intervention that one should use while teaching gross motor skills to young children with Ds! But how do these ideas fit with current educational theories of learning and development? Are there ways, based on current theories, to assess changes in understanding and performance and what type of intervention / measurement could indicate gains in motor skill and knowledge?

Current Theories of Learning and Development

Constructivism, according to Rankin (1996) is part of a progressive ideology and thinking in education and psychology, born out of the ideas of Piaget, Vygotsky, Dewey and others, which sees,

> development coming from the interaction of the child and the environment. In this view, the child is an active explorer who constructs and organizes his or her own development. This fundamental belief in the child as capable and strong is essential to a view of learning in which the child is seen as one of the protagonists capable of participating actively with other children and teachers in the learning process. (p. 36)

The main aspects of constructivism include reflective abstraction, endogenous reconstruction, cognitive conflict, and processes that promote active learning and development through reviewing, rethinking, reflecting, revisiting, and recognition of how experiences, ideas, and concepts become organized in meaningful ways (Rankin, 1997). Constructivism is a very popular educational approach in recent years (Braun, 1993; Breig-Allen & Dillon 1997; Chaille & Silvern, 1996; Edwards, et al., 1993, 1998; Eisert & Lamorey, 1996, Gardner, 1993; Hendrick, 1997; Jobling, 1996; Johnson, Christie, & Yawkey, 1987; Malaguzzi, 1993a, 1993b; Munroe, 1990; Nicolopolou, 1993; Sugarman, 1990). While this approach includes components of self and social-constructivism, because the social-constructive perspective is used in this research project, Vygotsky's (1978) theory will be highlighted, and followed by documentation from the motor literature that supports his ideas. Thereafter, information related to dynamic testing and the GP teaching format will be presented because those topics relate to and are considered practical applications of Vygotsky's theory, and they utilize purposeful social interactions that aim to influence learning and development within each child. In addition, these techniques are aimed at a

level just above the child's independent functioning and are thought to indicate the difference between the child's current level of proficiency and the potential ability of a child. This way, one may be able to assess a child's ability to learn and acquire skills in the psychomotor domain, and therefore, assess whether the psychomotor domain is modifiable.

Vygotsky's Social Historical Theory of Cognitive Development

Vygotsky (1978) believed that learning is a social phenomenon, a process in which people continually influence and are being influenced by others, that learning precedes development, and that the quality and quantity of such interactions affects the child's progress. He was influenced after reading Piaget's ideas about the construction of knowledge, however, his socio-cultural theory is different and incorporates many unique explanations about cognitive development. Although Vygotsky died at a young age, his original ideas have been described and represented in many other sources (Berk & Winsler, 1995; Bird & Buckley, 1994; Bredekamp, 1993; Crain, 1992; Edwards et al., 1993, 1998; Forman & Sigel, 1979; Gandini, 1993; Hart et al., 1987; Hartley et al., 1952; Hendrick, 1997; Johnson et al., 1987; Lee, 1989; Malaguzzi, 1993a, 1993b; Nicolopolou, 1993; Rankin, 1996, 1997; Rice, 1995; Rogoff, 1990; Vygotsky, 1956; Wertsch & Tulviste, 1992).

The basic premise of Vygotsky's theory is that the mind is a product of social and historic changes each child is exposed to during the years of growth and development. The interplay of developmental and environmental forces serve to construct psychological tools which aid thinking and behaviour in two planes -- the interpsychological and the intrapsychological. Vygotsky believed that cognitive development occurs through: (1) an interaction of internal and external forces; (2) an interplay between a "natural line" and a "social-historical line"; (3) a process by which information exchanged between individuals (interpsychological understanding) eventually becomes intrapsychological understanding; (4) the scaffolding of knowledge within an individual's "zone of proximal development" (ZPD); and (5) the mediation of cultural signs and tools from a more capable person to the learner using language.

Vygotsky's ideas appear complex, but one soon discovers that many of his concepts are interwoven and easily adaptable to several content and subject areas within education. In applying this within educational settings, a competent person purposefully mediates information related to a specific task to the learner at a level just above the individual's current level of independent skill or ability. Vygotsky believes that the learner will then be able to construct their own understanding of the concepts presented and that the knowledge will transfer from the interpsychological plane to the intrapsychological plane of the learner.

There is much support for Vygotsky's ideas when topics and teaching content related to modifying the cognitive domain, but scant references if applied to the psychomotor domain. While some motor literature discusses the importance of social influences and using observational learning on motor performance (i.e. demonstrating a particular motor skill as part of physical education instruction), most comment on the value of social interactions by reporting how children are socialized into physically active lifestyles through socializing agents, social situations, personal attributes, and cultural factors (Haywood, 1986; Kirchner & Fishburne, 1998; Schmidt, 1991; Smoll et al., 1988; Wickstrom, 1983). Nevertheless, there are others closely connected to learning and development in the psychomotor domain that seem to support several aspects of Vygotsky's theory, especially the ZPD and the value of scaffolding information from the inter to the intrapsychological plane.

Vygotsky (1978) defines the ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). Applied to the psychomotor domain, the "actual developmental level" may refer to a child's independent performance of skills and abilities and the "potential level" may refer to what a child does with assistance. In a book about children and sporting activities, LeBlanc and Dickson (1996) refer to a space between "skill" and "challenge". While their description is brief, it seems that skill refers to a child's ability to perform skills independently, and challenge relates to the potential level of development. The Peabody Developmental Motor Scales (PDMS) (Folio & Fewell, 1983) also distinguishes two outer limits of motor skill

acquisition, which may relate to a ZPD in this domain. While describing various criteria when assessing a child's gross motor ability, Folio and Fewell note that at times assistance is permitted (i. e. walking or jumping with adult assistance), and other times only independent performance is permitted. Skills a child performs with assistance are referred to as "emerging skills".

Frank (1963) suggests that children should be provided with materials, toys, and activities that are just on the "margin of their capacities". He writes that these will challenge, stretch, and provide emotional benefits because the child enjoys the triumph in mastering them, and when working in the margin of their capacities, a child is able to develop interests and skills. While Frank does not refer directly to the psychomotor domain in his book, one may assume it's inclusion because of the importance that movement plays in a child's life.

According to Vygotsky (1978), it is common and quite natural for adults to facilitate skill acquisition in this ZPD by encouraging children in their abilities. In explaining Vygotsky's theory, Crain (1992), actually utilizes an example of a common gross motor task. He writes,

> By focusing on the activities that a child can accomplish with assistance, the zone reveals those abilities that are just beginning to develop - like the ability to walk in an infant who can do so only if she has a hand to hold. The zone of proximal development casts light not so much on 'the ripe as the ripening functions' - those that the child can only carry out with assistance today but will be able to perform alone tomorrow. (pp. 214-215)

Gerber (1987d) notes that great care needs to be taken to develop a balance between the amount of adult intervention and independent exploration by the child while acquiring motor skills, since learning and development evolves as a joint effort between caregivers and infants. Rankin (1996) also comments on the need for competent others to let the learning be performed by the child -- not forced on the child. She quotes Rinaldi, "The challenge is for the adult to be present without being intrusive in order to best sustain cognitive and social dynamics while they are in progress" (p. 13). Gonzalez-Mena and Widmeyer Eyer (1980) also reinforce the need to balance adult help with the child's interest, and the idea of a "region just above independent performance". They state, "Learning occurs when the environment provides experiences just familiar enough that the child can understand them with the mental ability he

has already attained, but just new enough to offer interesting challenges" (p. 70). If a child "gets stuck" in the learning process, an adult may facilitate with a small amount of help. This is "the tiny link that allows the child to move forward again...[a form of] selective intervention..." (p. 71.)

Crain (1992) reports that this purposeful but small amount of instruction does propel the mind forward, it interacts with development, and this interaction results in the charting of new paths. This is why some instruction by a more capable individual is necessary to facilitate learning and development. Schmidt (1991) comments about how a competent person can facilitate the forward progression of an individual's motor skills. He notes that the practice of motor skills typically takes place with a competent instructor, therapist, or coach. This person generally guides the learning process, evaluates the learner's progress, and then decides on the activities which will maximize progress. Cratty (1973b) also sees the teacher as a more capable individual who can make a difference for the learner within their region of motor abilities.

> The instructor, with his theoretically better background, should be able to offer the learner the best advice necessary, relative to skill mechanics, so that qualitative self-instruction may take place. The teacher or coach should determine what elements occupy the learner's attention before interjecting his comments and instructional efforts....In general, the instructor should attempt to determine the nature, type, and timing of the learner's self-instruction, and then in a compatible and helpful way he should insert his instructions into the consciousness of the learner. (Cratty, p. 57)

Although they do not refer to social-constructivism, the references cited above seem to capture many of the ideas of this educational approach and relate it to the acquisition of motor skills!

It is unfortunate that there is so little emphasis and value placed on the practice of having competent others purposefully impact cognitive processes during psychomotor learning and development, because many references seem to comment on it's usefulness as a teaching strategy. Throughout this review of literature, some theories and research results support the idea that an excellent way to facilitate learning and development in the psychomotor domain and to address the construction of knowledge about movement experiences, is to explain and show concepts related to motor skill performances using

cognitive forms of intervention, before asking the child to move their body!

Eisner (1982) supports this. He writes, "What we seek in education is the cultivation of intelligence in the several modes in which it can operate. We seek to liberate rather than to control" (p. 56). Furthermore, because humans "need to receive and convey information in forms that capitalize on the use of different sensory systems" (p. 74), educators should facilitate the use of different sensory systems, expand the scope of curriculum, present information in numerous ways, and encourage new ways for learners to represent and express their knowledge. We must not teach that there is only one way to treat or solve problems; teachers must be willing to present information in different ways in order to extend the processes of learning and development. For example, by scaffolding information purposefully to a child before they are asked to participate in an activity, they can process information before moving. Then, after the task is completed, teachers may also provide time for children to rethink and reflect on the tasks just experienced. This way, children will be free to construct their own understanding of the concepts and exhibit or express their ability in those activities. Use of such formats may even facilitate additional exploration and learning in multiple domains (Eisner, 1982; Cratty, 1973a; Gardner, 1993; Holt, 1995).

But, is it possible to apply a socio-constructivist approach to learning and development with young children, and if so, has it been done with young children with Ds, and how was it done? Yes, while there are very limited references available in the literature, it has been done.

Use of Socio-constructivist Practices with Children with Ds

Under the guidance of Malaguzzi, preschool programs that use the socio-constructivist approach were set up for children initially in Reggio Emelia, Italy. This educational approach was developed and implemented over thirty years ago, and remains the subject of intense interest in the field of education (Abramson, Robinson, & Ankenman, 1995; Braun, 1993; Bredekamp, 1993; Breig-Allen & Dillon, 1997; Edwards et al., 1993; 1998; Gandini, 1993, 1995, 1997a, 1997b; Hendrick, 1997; Malaguzzi, 1993a, 1993b; Rankin, 1996, 1997). While most of the children served in the Reggio Emelia schools are typically

developing children, two recent articles (Gandini & Gambetti, 1998; Kaminsky, 1998) described ways to make the socio-constructivist approach practical while working with children who experience various disabilities and / or difficulties in learning and development. Gandini and Gambetti document the participation of a young boy with Ds in this educational approach. The student was able to use movements and physical skills to communicate abilities and ideas, and these techniques also seemed to help his memory. Unfortunately, most of the efforts at Reggio Emelia concentrate on the cognitive, affective, and communicative domains. When questioned, Forman (1997), a researcher actively using these principles for learning and development, commented that the psychomotor domain was not considered as an area with which to apply these ideas!

One other recent reference documented the practical application of socio-constructivist theory to a person with Ds. In a foreign newspaper, Westenberg (1997) reports on Peetjie, a Dutch teenager with Ds who, according to her mother, had been unmotivated and simply responded how people wanted her to, until she had an opportunity to learn to think for herself. Using a specific type of assessment / intervention, Feuerstein was credited as introducing a way for her to learn to organize her thoughts, reason, and problem solve. In essence, Peetjie was taught to create her own knowledge and make meaning of information, ideas, and experiences. She used these skills to eventually graduate with a nursing diploma in June 1997; the first person with Ds in the Netherlands to graduate from high school with a "normal" diploma!

And so, it seems that by daring to try a practical application of the socio-constructivist theory with students with Ds, the teaching can make a difference. Since educators desire to determine which teaching strategies are effective and make a difference in a child's life (Braun, 1993; Eisner, 1982; Gandini, 1993, 1995, 1997a; Gardner, 1993; Hendrick, 1997; Holt, 1995; Malaguzzi, 1993a, 1993b), by trying different educational interventions, educators may also discover what techniques are effective.

A critical question remains: How does one assess what exact techniques are beneficial? Do any assessment formats claim to be able to determine which teaching strategies and tools are most effective in a particular setting? Some believe there are.

Dynamic Testing

Grigorenko and Sternberg (1998) credit Feuerstein and his colleagues for developing a unique form of assessment which (a) describes and emphasizes the psychological processes involved in learning, (b) includes instruction as an important part of the testing process, and (c) purposefully establishes a collaborative relationship between the examiner and the person being tested. Typically applied towards gains in the cognitive domain, Grigorenko and Sternberg identify different types of dynamic testing, writing that common to all is the goal to quantify the process and products involved in learning, but also the potential of an individual to learn new skills and abilities. Grigorenko and Sternberg add that the principles of dynamic testing fit with Vygotsky's theory, even though not all adherents to this form of assessment claim to use his theory as a basis for their approaches. Nonetheless, dynamic forms of testing seem better suited to determine one's potential to change than static forms of assessment. Therefore, dynamic testing will be utilized in this research project.

Others use different terms and definitions to describe what Grigorenko and Sternberg (1998) call dynamic testing. Samuels, Klein, and Haywood (1994) write that dynamic assessment permits the measuring of one's current and potential cognitive abilities, and that it incorporates a test-teach-test format

> in which the examiner teaches cognitive operations and strategies or provides feedback with the intent of observing the effect of this intervention on subsequent performance. Dynamic assessment is designed to go beyond the goal of simply describing the learner's difficulties and matching appropriate instruction to a goal of promoting structural changes in the course of assessment. One of the goals of dynamic assessment is to gain a clear understanding of the amount and type of input needed to modify cognitive functions. (p. 3)

There are different goals and procedures within dynamic assessment; Grigorenko and Sternberg refer to four main types: (1) metacognitive interventions aimed to impact general concepts and principles, (2) formats promoting learning within assessment situations, (3) altering test situations so a child can produce better performance outcomes, and (4) interventions which purposefully train one particular cognitive function. They state that of these types, purposeful teaching during an assessment period, best indicates a child's potential, or ZPD. The

method facilitating this is the GP method, or hinting procedure.

The Graduated Prompt Method

Campione and Brown studied and promoted the underlying procedures of Vygotsky's theory, and as a result developed the GP method. Used in the last twenty years (Brown & Campione, 1986; Brown & Ferrara, 1980; Brown & French, 1979; Campione, 1989; Campione, Brown, Ferrara, & Bryant, 1984; Missiuna, 1986), the purpose of this method is to develop a supportive form of intervention wherein individuals are offered gradual assistance until they can solve a test task independently. Burns (1985) describes the GP method as "a series of hints or prompts presented in a graduated sequence of increasing explicitness; children receive these aids in order to learn the rules needed to solve the problem correctly" (p. 3). Grigorenko and Sternberg (1998) write that the "key concept of this approach is *transfer* (maintenance of learning), or an individual's ability to use learned information flexibly and in a variety of contexts" (p. 93). Campione et al. believe that a child with a broad ZPD requires a few prompts, and that a child with a narrow ZPD requires more prompts to advance learning. The amount of prompts used is said to indicate the child's efficiency of learning (Grigorenko & Sternberg).

Typically, the steps involved in the GP method of intervention include a pretest, the intervention or "hinted stage", a static post test, and a hinted post test. The GP method is considered successful if one's task performance improves as a result of the instructions given, if the gains are considered durable, and if the results of the training transfer to tasks other than those used in the intervention (Brown & Campione, 1986; Grigorenko & Sternberg, 1998). But, dynamic testing has been used primarily as a psychoeducational assessment indicating modifiability within the cognitive domain. Would it work in the same way if applied to the psychomotor domain? If so, it may be able to determine if the psychomotor domain is also modifiable!

The GP format used in this research project is not the same as the test-teach prompting hierarchy sometimes referred to in books and programs of instruction designed for students with disabilities (Baine, 1996; Block, 1994; Eichstaedt & Lavay, 1992; Sherrill, 1993; Watkinson & Wall, 1982). The test-

teach prompting progression developed by Snell and Zirpoli (1987) consists of four levels -- starting with verbal commands only, then verbal and gestural prompts, verbal prompts and modelling, and verbal instructions with physical guidance or prompts. The last level is only used when other instructional techniques have not been effective. Test-teach prompts are used to minimize assistance to learners, introduced only if necessary, and then removed as soon as it is apparent that the child is able to manage on his / her own.

Variations of the prompting hierarchy exist in published physical education curricula for young children. The PREP Program identifies four levels of teacher assistance which includes verbal, visual, physical, or no prompts. The I CAN Program uses verbal requests, demonstrations, and physical assistance, along with "peer models, reinforcement, feedback, concreteness, repetition / practice and involvement / experience / participation." (Wessel, 1976; p. 37). These test-teach prompts are designed to minimize assistance to the learner -- strategies are only introduced if necessary and then removed as soon as it is apparent that the child is able to manage on his / her own. In contrast, GPs are designed to: be part of a dynamic assessment, maximize rather than minimize assistance to each learner, and determine exactly what types of prompts or teaching strategies would accomplish change for a particular child. The prompting techniques used in this project were designed to encourage each child to think about the psychomotor concepts -- without telling him how to act or respond.

A thorough review of the literature did not reveal any studies using a GP method, or other forms of dynamic testing, within the area of motor learning and development. However, a few individuals interested in the psychomotor domain comment about the benefits of utilizing forms of guided or graduated instruction to teach physical skills (Burton & Miller, 1998; Fitts & Posner, 1967; Mosston & Ashworth, 1994; Schmidt, 1975, 1991). Since there is support for this teaching method and the acquisition of psychomotor skills and abilities involves cognitive processes, then it stands to reason that GPs could indicate change in the psychomotor domain. However, since this method has never been applied to gross motor learning and development, how could one determine if the intervention really made a difference for a child? What if a child understood the motor task but could not perform it physically? Is it possible to determine a

child's potential to learn motor skills? One strategy may be to use a predetermined series of hints, which range from general to specific, and purposefully present the prompts in collaborative ways targeted at a motor skill that a child appears interested in, but does not perform efficiently yet.

Use of Dynamic Testing / Graduated Prompts Within the Psychomotor Domain

Although dynamic testing has not been utilized in the psychomotor domain, there is a growing recognition of it's value, and a need to assess knowledge of product and process in new ways (Block, 1991; Burton & Miller, 1998; French & Nevett, 1993; Reid, 1990). Burton and Miller write that measurement techniques within the motor area need to be reexamined, and that dynamic forms of assessment may provide "assessments to be more closely integrated into the instructional or therapeutic process" (p. 101), or actually become "integrated with instruction" (p. 328). They state that there are very few tests which measure motor skills for children between 2.5 to 4.5 years of age, and add that social situations need to be considered in motor tests. Chamberlain and Coelho (1993) also support the need for dynamic tests within motor skill acquisition because most motor behaviours and actions occur dynamically. The lack of dynamic assessments in the motor area is unfortunate, for these tools appear to be very valuable methods by which one can determine specific intervention strategies that make a difference to learning and development in this domain.

In summary, some references in the motor literature suggest using interventions which involve scaffolding -- the transfer of information from competent individuals to learners. Others, using a socio-constructivist perspective in education purposefully do the same to modify the cognitive domain. If functions in the cognitive domain can be modified using scaffolding techniques such as GPs, then it follows that functioning in other domains may also be modified using similar strategies. Furthermore, because the psychomotor domain includes aspects of cognition in the planning and execution of movement, one would think it natural to try to influence cognitive processes while learning about movement of the human body. Burton and Miller (1998) quote Morris, Matyas, Iansek, and Cunnington (1996), who write that one may be able to impact motor skill acquisition this way, for unless the brain is so impaired, "there is no reason

why such learning processes would not also be accessible for optimization of motor action in people with movement disorders" (p. 325). Therefore, by using GPs which focus on the cognitive processes involved in motor activity, one may influence a child's knowledge structures and understanding about motor skills, and thereby modify the psychomotor domain! It is as if knowledge acquired within one domain transfers to another domain.

The concept of transfer from one domain to another is supported by Gardner (1993), who writes that while one type of intelligence generally serves as the content of instruction and medium for communicating knowledge within that realm, other intelligences may also facilitate gains in different realms, because secondary routes to learning solutions exist. This supports the need to offer multi-modal and interdisciplinary forms of instruction to students.

Teaching Children Using Interdisciplinary Practices

There are individuals who support the practice of teaching children using interdisciplinary techniques and explain why such endeavors are important (Bailey, 1996; Bricker & Widerstrom, 1996; Burton & Miller, 1998; Holt, 1995; Gonzalez Mena & Widmeyer Eyer, 1980; Jobling; 1996; Leland, 1983; McCollum & Stayton, 1996; Mosston & Ashworth, 1994). For example, Gardner (1993) writes if a student has a particular weakness which is identified early, there may be alternative ways to deal with it -- ways to teach or cover important skill areas. He states that people must be given opportunities to learn and problem solve in various ways because we are made of a collection of different abilities and skills. Therefore, if experiencing difficulty in motor skill acquisition, learning and development may be facilitated by blending and transferring knowledge from other domains to the area encountering problems. Others comment that by teaching in holistic or multi-modal ways, children may develop a more complete understanding of concepts, and this may unknowingly influence learning and development in one domain of behaviour, two, or all three (Cratty, 1971, 1973a; Eisner, 1982; Gardner, 1983; Holt, 1995; Moran & Kalakian, 1977).

Educators implementing current theories of human learning and development explain that cognitive processes are regularly facilitated using

interdisciplinary techniques through children's self-initiated interests, active curiosity, and self-organizing techniques (Edwards et al., 1993; 1998; Gandini, 1993, 1995, 1997a; Hendrick, 1997; Malaguzzi, 1993a, 1993b; Rankin, 1996, 1997). Unfortunately, while educators grounded in current theories of learning and development strive to encourage interdisciplinary connections within children, people who instruct, write about, or design and implement programs for infants and young children with Ds, seldom comment on this (Bird & Buckley, 1994; Block, 1994; Dmitriev, 1988a; Eichstaedt & Lavay, 1992; Hanson, 1988; Harris, 1981, 1984; Kelso & Price, 1988; Oelwein, 1988b, 1995; Sherrill, 1993; Tingey, 1988a; Winders, 1997; Zausmer & Shea, 1984).

Several programs have been developed which use cognitive processes to influence other domains of behaviour. For example, Meichenbaum's (1977) self-instructional training program, also known as cognitive behavior modification, was originally designed to help children with impulsive and hyperactive behaviours perform academic tasks more successfully (Meichenbaum & Goodman, 1969). His ideas were later expanded (Baine, 1986; Meichenbaum & Gilmore, 1984) and applied to the health care profession (Meichenbaum & Turk, 1987), assisting students to become more independent learners (Meichenbaum & Biemiller, 1998), helping people reduce stress in their lives (Burgio, Whitman, & Johnson, 1980; Meichenbaum & Cameron, 1983) and to acquire proper social skills (Spivack & Shure, 1974). Meichenbaum and Biemiller refer to predetermined graduated prompts and comment that they are an important strategy which facilitates cognitive change (p. 142). However, cognitive behaviour modification procedures were not considered suitable for this project because the strategies and self-analysis needed to be effective were thought to be too complex for preschoolers with Ds. In describing the steps required to develop a cognitive behavioural modification program, Baine (1986) cites Harris (1982),

> Learner analysis is a complex, difficult and necessary task. Ideally, task and training requirements must be compatible with the learner's language development, learning style, knowledge and currently employed problem solving strategies, responses to behavioural antecedents and consequences, and the individual's intellectual level. (p. 121)

The children with Ds who participated in this study were: developmentally much

younger than the learners that Meichenbaum and others worked with, not participating in a long-term intervention program, probably unaware of the concept of voluntary behaviour control, and they may not have been able to recognize maladaptive behaviours in order to replace them with more adaptive strategies. In addition, cognitive modification techniques were not suitable for the children involved in this study since Meichenbaum's training program was based on Vygotsky's premise that true voluntary behaviour only arises after there is a shift from external to internal language control in people. Children with Ds are significantly delayed in their external speech and language production (Beeghly, Weiss-Perry, & Cicchetti, 1990; Dmitriev & Oelwein, 1988; Elliott, 1990; Foley, 1995; Johnson-Martin, Attermeir, & Hacker, 1990; Kumin, 1994; Mattheis, 1995; Spiker, 1990; Strominger, Winkler, & Cohen, 1984). Therefore, the children participating in this research would probably have a difficult time imitating the adult's exact verbalizations, producing overt self-prompts without any assistance, under-standing how to whisper instructions to themselves, and how to produce the required tasks while using covert self-prompts. When children experience great challenges in producing overt verbalizations, it seemed unreasonable to know with certainty when internal language control occurs.

Although the discussion above explains the importance and value of using interdisciplinary efforts, the lack of such programming for preschoolers with Ds, and ways in which cognitive strategies have been used to influence other domains of behaviour with older learners, other questions remain. Could and how would one impact the cognitive and psychomotor domain simultaneously during educational interventions? Would it be possible to observe differences in motor behaviour and / or would children display their knowledge about motor activity in other ways? Is it even possible to measure cognitive engagement related to the psychomotor domain? How would children display this knowledge, and, how would one assess this for a child with Ds?

How Will Knowledge in the Psychomotor Domain be Measured?

The idea of accessing knowledge of concepts in the psychomotor domain is relatively new (Starkes & Allard, 1993, Rink, 1996). Many assessment tools

claim to measure motor development in children (refer to Burton & Miller (1998) for an excellent overview). However, there are no tools which assess a child's cognitive understanding, or knowledge of motor related concepts. Currently in the area of kinesiology, a person is judged to have learned a new motor skill when a relatively permanent improvement in performance is noted as a result of practice or experience. Gains are generally measured this way because motor learning processes cannot be seen, and therefore, learning can only be inferred from observation (Fitts & Posner, 1967; Kirchner & Fishburne, 1998; Haywood, 1986; Magill, 1993; Robb, 1972; Schmidt, 1975, 1991; Shea et al., 1993).

Cognitive knowledge is typically assessed in ways totally unrelated to gross motor performances. Generally, one's knowledge / understanding of concepts is measured in formal ways using specific cognitive tests. Sattler (1992) reviews six commonly used assessment tools that claim to measure cognitive ability in young children. These tests are highly structured and utilize questions / tasks which focus on logical, mathematical, and communication skills. Among other strategies, children are simply asked to view pictures or listen to verbal details and then provide answers about similarities, missing aspects differences, comprehension, and other such information; or they may be asked to identify items, complete fine motor tasks, draw by copying; and / or reproduce designs using various objects. Similar strategies have been introduced by French and Nevett (1993) when assessing declarative knowledge in sport experts, however, these formats have not been utilized with young children, and certainly not with young children with Ds. Other ways to measure their ability must be found.

Linder (1993), Wessel (1980a, 1980b), and Watkinson and Wall (1982) write that the observation of children's play provides a great deal of information; the later two references even use free-play as a way to assess a child's current gross motor skill ability. Cunningham (1988) and Eisert and Lamorey (1996) also support the value of free-play as a form of assessment. In a book about children with Ds, Cunningham states that standardized assessments do not provide equal opportunities for a child with a disability to perform, and therefore, observation of their free-play may be more suitable. Burton and Miller (1998) agree. One may better see a child's strengths and weaknesses by observing them in various locations, because, by watching and recording how a child

goes about everyday activites, including play, one may discover the child's independently functioning skills and abilities.

The Need to Develop Alternative Forms of Assessment for Cognitive Functions

There are many who support the need for alternative forms of assessment (Feuerstein et al., 1979; Gardner, 1993; International Association for Cognitive Education, 1999; Samuels, 1997; Tzuriel, 1997). They state that the traditional forms of cognitive assessment which focus on narrow bands of intelligence are too limiting, and by focusing only on one type of intelligence, a student may be deemed incompetent. Therefore, evaluators must utilize a wide variety of strategies and consider including multiple intelligences. This will result in better assessments, and an ability to better determine the level of a child's abilities and their understanding of various concepts. Gardner writes, that to facilitate assessment in various forms of intelligence, such as the bodily-kinesthetic, educators should look at genuine problem solving abilities / product-fashioning skills across a range of materials using the properties of that intelligence. It seems reasonable then, if desiring to assess cognitive functioning in psycho-motor activity, one may need to adapt the content of and manner in which questions are asked. Therefore, rather than using traditional logic-mathematical tasks within cognitive assessment formats, one may better determine a child's understanding of motor skills by changing the focus of questions to movement related concepts. Is there support for such adapted techniques?

Yes. French and Nevett (1993) cite numerous references who report that declarative knowledge related to physical activity has been examined in adults. Rink (1996) also describes ways in which grade nine students were asked about their understanding of motor related concepts. And, Gardner (1993) while not referring directly to motor skill acquisition, also comments about the value of using various forms of assessment when measuring cognitive understanding. He offers specific suggestions, stating that assessments should be more open-ended, include probing questions, materials that are in the child's own environment, and opportunities for active hands on learning and testing. Gardner actually challenges people to devise alternative forms of assessment, to create environments in which intelligences can be assessed in natural and

fair ways, and to offer situations in which children are comfortably able to display their learning. Brown and Campione (1986) also comment that students need non-threatening environments and assessments, so they can display their knowledge during the ongoing process of learning and development. They add that such assessments are important because this way, competent others can gauge a learner's competency or learning between various trials.

Gardner's (1993) ideas differ from the traditional ways in which children are asked to explain their understanding of various concepts. Preschool-aged children are frequently asked to look at pictures and respond with words, even though oral answers are limiting and children frequently know more than what they can express (Bird & Buckley, 1994). In addition, children with Ds experience great difficulty in expressing knowledge through the spoken word. Bird and Buckley comment that since children with Ds typically have difficulty in speech production, they may not be able to accurately represent their understanding of certain concepts. As a result, adults may underestimate their ability and therefore, not offer appropriate learning experiences.

Many people working with children with Ds report the need to develop more visual forms of instruction for learners with Ds because of their aptitude to acquire or remember information this way (Block, 1991; Dunst, 1990; Oelwein, 1995). For example, Elliott (1990), citing others, reports that people with Ds "tend to exhibit performance advantages when compared to subjects of a similar mental age on tasks that involve a visual-motor ability and visual pattern discrimination" (p. 202). Cicchetti and Beeghly (1990a) also cite individuals who report that visual information facilitates motivation for movement, the monitoring of posture, and plays an intrinsic role in the achievement of normal motor control. De Graaf (1995) adds that children with Ds need visual and proprio-ceptive feedback to facilitate movement acquisition, and Spiker (1990) found that verbal and manual support did not support learning in preschoolers with Ds as much as visual information and support did. So, by developing interventions that provide visual cues to the child with Ds, declarative knowledge related to certain skills may be better facilitated. Starkes (1993) suggests that "marking" or "rehearsing", a motor equivalent of verbal rehearsal, may be done as the visual presentation of stimuli occurs, or immediately after a motor skill is shown.

The literature suggests that visual and less verbal demanding interventions and assessments, and those providing alternative forms of expression, such as movement opportunities, will be most effective for children with Ds. This is true for all children, not just those with Ds, because, as Stinson (1988) writes,

> Preschool ... children come to us as totally integrated beings. They are equipped as thinking, feeling, acting, and reacting entities fully capable of expressing themselves through a variety of modalities. Central to this integrated unity and essential as an expressive modality is the medium of movement. Children differ in the range of their abilities, strengths, and needs, but movement is central to the very existence of all. (p. 1)

Others support the need for children to have movement opportunities to express themselves. Hartley et al. (1952) writes that the child's "body is an organ of expression as well as perception, and that his attitudes toward himself and the world about him are expressed in the way he uses his body more fully than his verbalizations" (p. 7). Beeghly et al. (1990), Berger (1990), Dunst (1990), and Serafica (1990) also report that movement allows opportunities for children with Ds to express themselves. They write that any motor, manual, or gestured response such as pointing, selecting, and indicating, are better for children with Ds because they have difficulty organizing and producing spoken answers -- even when they understand the question and can find the solution to a task.

Along with providing new ways for children with Ds to express themselves, there are other important factors related to intervention and assessment techniques which one must consider. All strategies or techniques used must be creative, informal, and adaptable, suit the research participant's interests, current functioning and developmental abilities, and their willingness to experiment and cooperate (Chaille & Silvern, 1996; Wall, 1990; Widerstrom et al., 1991). This is because some children do not display adequate language, cognitive, physical, or social-emotional maturity (Brown & Campione, 1986; Burton & Miller, 1998; Widerstrom et al., 1991), and traditional assessments and conventional forms of representation may not provide children with enough different formats to express what they know or can do (Berk & Winsler, 1995; Breig-Allen, & Dillon, 1997; (Burns, 1985; Campione, 1989; Cratty, 1973; Eisner, 1982; Gardner, 1993; Grigorenko & Sternberg, 1998; Holt, 1995; Jobling, 1996; Kaminsky, 1998; Kopp, 1990; Mosston & Ashworth, 1994;

Samuels, 1996, 1997).

Eisner (1982), Gardner (1983), and Bushner (1988) suggest that children need various tools, symbols, intervention strategies and alternative forms of representation and expression, because each child constructs, comes to an understanding of various concepts, and communicates their knowledge in unique ways. Chaille and Silvern (1996) also agree with this. They remark that interests, understandings, and expressions belong to the individual child, and therefore, each child will not express knowledge in the same way or act with the same understanding. Furthermore, Eisner writes that by providing children with the opportunity to work within new and different mediums, children generally become motivated and need to think creatively. As a result, other ideas may be formed, negotiated, rediscovered, and revised. This is because different forms of representation emphasize different sensory perceptions, different responses require different psychological processes, and the action and conception of an idea often arrives simultaneously.

Gardner (1993) gives a clear reminder about one very important aspect of assessment. He writes that although a child may have learned and acquired specific skills within the framework of one intelligence, the learner must also translate information back into the prior intelligence domain to see whether learning and development has been influenced. "Unless one is able to assess the learning that takes place in different domains, and by different cognitive processes, even superior curricular innovations are destined to remain unutilized" (p. 79). He adds that people need to be able to look directly at the kinds of learning that they are interested in. And so, it seems that psychomotor assessments may need to include two components, a physical aspect and an element aimed at the child's cognitive understanding of a motor task.

This need for two types of assessment is also supported by Starkes and Allard (1993), Rink (1996), and Mosston and Ashworth (1994) who write that when assessing the child's ability in the psychomotor domain, one should utilize cognitive and motor components in order to ascertain the differences in cognitive and physical ability. They comment that because cognitive processes and motor performances are intertwined in psychomotor skills, one must ask for more than one display of knowledge or ability during assessment processes.

So, to determine whether or not the psychomotor domain is modifiable in preschool aged children with Ds, it seems that the teaching / assessment tools for this research project need to be customized, use ideas and knowledge from multiple domains, and include cognitive and motor components. This will provide numerous ways for the child to construct their own understandings of concepts, permit different displays of knowledge, and create more than one way to measure the child's understanding and performance of psychomotor concepts and abilities. French and Nevett (1993) report that a few assessment forms have been developed which examine the contents of declarative knowledge for use with adult sport experts. Declarative knowledge of motor skills was assessed through their participation in (a) sorting tasks, (b) recall -- as in using pictures or drawing the position of players, (c) pictorial resequencing tasks, and (d) multiple choice paper-pencil tests. Rink, French, and Tjeerdsma (1996) report grade nine students used (a) knowledge tests, (b) situational interviews, (c) error detection of other players, and (d) basic recall of game formations to indicate their awareness or declarative knowledge in the acquisition of badminton skills. French and Nevett also add that video tape recordings are useful in helping researchers analyze motor components and cognitive responses.

Gardner (1993) challenges people working in different fields to explore the various intelligences, and research them by conducting and creating distinctive intervention and assessment tools. He believes that children deserve serious attention in this matter, practitioners and care givers should use thought and action experiments when interacting with children, and all forms of intervention should be done using uniquely crafted methods and creative opportunities. This research project accepts his challenge to intervene and assess children's abilities in new and different ways. By using GPs within a dynamic asessment, where the various interventions will progress systematically from abstract to concrete prompts, this research seeks to discover if the psychomotor domain is modifiable in children with Ds, and if so, which of the intervening strategies or prompts appeared most effective.

Summary of the Problem

Ds typically impacts the cognitive, affective, and psychomotor domains of behaviour in various ways throughout the life span. The effects of Ds on the various domains is typically determined using formal standardized assessment tools which measure a child's current level of performance on multiple tasks. Unfortunately, there is little effort placed on establishing what a child with Ds can do with assistance, or what the child's emerging skills and abilities are.

Nevertheless, as a result of the effects of Ds on individuals, since the 1960's, numerous long-term intervention strategies have been initiated on children with this genetic condition with the goal of promoting their learning and development. While many programs claim to provide short term gains, others report that such programs do not have lasting benefits. However, what has been confirmed is that children with Ds are more motorically delayed than cognitively delayed in development.

Long-term intervention programs attempt to reduce developmental delays in children with Ds. The goal of such infant programs is to facilitate gross motor skill acquisition by repeating specifically designed physical exercises. Based on a neuro-developmental approach, these interventions focus on specific physical skills in isolation and almost no attempt is made to influence other domains of behaviour concurrently -- even though the acquisition of motor skills is known to include psychic and physical processes. Motor skills which are acquired simply through physical movement and repetitive practice may lose their effectiveness over time because the cognitive processes involved in movement are not engaged.

Only a few individuals working in the field of motor learning and development comment about the relationship of cognitive processes to psychomotor skills and abilities, and fewer yet have conducted research in this area. The teaching of motor skills typically follows a C&P format which focuses almost exclusively on physical aspects of the skills, even though some theorists and practitioners suggest that interdisciplinary methods of teaching may be more effective. A guided approach which permits students to construct their own understanding of motor skills and concepts may accommodate learning and development of gross motor skills. This later perspective also matches current

theories of learning and development within the field of educational psychology.

Some constructivist approaches currently used in education adopt the ideas of Vygotsky's socio-historical theory. One practical application of his theory is the GP format, a type of dynamic testing, which includes intervention during assessment within a test-teach-test design. Dynamic assessments using GPs have not been used in the field of motor learning. However, because these intervention and assessment strategies claim to modify the cognitive domain and motor research supports the blending of cognitive and physical components together while teaching motor skills, it is reasoned that these strategies may help learners acquire gross motor skills. Therefore, GP teaching tools and assessment strategies were developed to investigate modifiability of the psychomotor domain in preschool aged children with Ds. Based on numerous suggestions, the teaching and assessment tools created were distinctive, suited to the needs of children with Ds, and, aimed at and designed to use the materials of both the cognitive and physical domains. In addition, prompts were presented one at a time, because as Elliott et al. (1990) report, "From a practical point of view, examining the ability of Down's Syndrome persons to perform a series of movements to different types of cues may give us greater insight into some of the factors that determine the limitations in teaching these individuals novel motor skills" (p. 1308).

By documenting each child's activities and behaviours before, during, and after the different intervention / prompting techniques, findings may reveal process and product differences in psychomotor behaviours, and the specific prompts or teaching interventions that seemed to make a difference for each student. In doing this, one may come to understand whether the psychomotor domain is modifiable.

Assumptions and Challenges

Several assumptions were made before this project began. The main assumption was that interventions aimed at influencing cognitive processes would positively influence motor behaviours in young children with Ds. Furthermore, it was assumed that a systematic study of individual children would provide some understanding of the thought and motor processes

involved in the psychomotor domain. Challenges were how and where to investigate this.

To address these assumptions and challenges, a pilot project was conducted with three young children with Ds in the fall of 1998. After only two visits to the research site, the parents of each child and I discovered: (a) the location chosen invited spontaneous gross motor activity, (b) one hour was a suitable time period for research activity, (c) by observing play, we were able to establish independently functioning skills and abilities of each child, and (d) a floor plan / map of the playground was a very effective way to document each child's motor activity. The floor plan / maps revealed time spent in various locations and the different skills attempted on the playground equipment. As a result of the mapping, we were able to determine that all three children enjoyed both sliding and jumping related activities, even though they were unable to perform these skills independently with mature posture and form. Therefore, based on the child's self-initiated interest, involvement, and ability in sliding and jumping, these skills were targeted for the preliminary project.

During the weeks that followed, the parents and I developed different teaching tools necessary for the GP formats for sliding and jumping. Then, while I used all of the teaching tools in one assessment attempt, each parent video taped their child's responses to the test-teach-test session. We were able to establish that: (a) close observation of each child was an effective way to capture the child's responses to the assessment session, (b) it was important to have children who were independent movers as research participants, (c) research would need to be conducted on one child at a time, (d) video records were a suitable way to document each child's response, (e) simple and clear speech was an appropriate way to communicate with children with Ds, (f) children understood and responded to verbal instructions, (g) the GP teaching tools would need to be presented one at a time, (h) children seemed willing to show their cognitive understanding of the motor tasks in various ways, (i) some equipment in the playground seemed too big and "frightening" for children to use, (j) it was difficult and time consuming to follow children through the playground equipment, and (k) it was tiring for the child to move from the assessment location to the slide or trampoline in the playground after each GP

was given. Therefore a separate "intervention room" with smaller slides and trampolines would need to be created near the main play area.

I also found that parents were willing to assist in the project and other family members (i. e. siblings) did not interfere with the project goals and activities, as they were engrossed in their own gross motor play. During the pilot project, parents mapped their child's activity on the floor plan / map, did some simple journaling, and were interviewed several times. One parent proof-read a detailed description of their child's participation in the pilot project as a way to check for skewed descriptions of the child's responses to the interventions.

As a result of the findings of the pilot study, a research design was developed to investigate modifiability of the psychomotor domain in children with Ds.

Aims of the Present Study

The purpose of this research was to explore whether the psychomotor domain was modifiable in young children with Ds. This was investigated using a socio-constructivist approach. The GP format, which employed different forms of intervention, was implemented within a test-teach-test session, to determine if modified knowledge of motor concepts or other modified motor behaviours were found in preschool aged children with Ds.

This study was based on research which suggests that: (a) psychomotor skills and abilities include cognitive processes, (b) the cognitive domain is modifiable, (c) interventions using declarative (cognitive) and procedural (motor) knowledge are effective for motor learning, and (d) children with Ds may better comprehend motor skills and concepts presented through cognitive formats because of greater competency in cognitive abilities than motor abilities.

The main research question was: *Is the psychomotor domain modifiable in preschool aged children with Ds?*

To investigate this, other research questions included:

1) Are there differences in the ways children perform sliding and jumping activities before and after being presented with various interventions -- as part of a dynamic assessment?

2) If so, how are they different?

3) Which intervention within the test-teach-test session appeared to influence the learning and development of psychomotor skills?

4) Is the child's knowledge of motor skills affected as a result of the various types of interventions used in the dynamic assessment?

5) Did the graduated prompt form of intervention, conducted within the dynamic assessment, appear to affect the psychomotor domain?

CHAPTER THREE
METHODS
Introduction

This section describes the researcher's personal paradigm, goals of the project, and research design chosen. This is followed by detailed information on sample selection, data collection, and analysis.

Researcher's Paradigm

There are numerous ways to conduct research within the social sciences (Vogt, 1993). Quantitative methods typically attempt to control variables within experimental conditions while an objective outsider views differences between groups or within subjects, looking for cause and effect relationships. In contrast, qualitative methods tend to verify theories or generate descriptions that are grounded in the data gleaned from the study and attempt to view issues from an insider's perspective (Mertens, 1998). One method is not better than another, however, decisions about which research method to use ought to be based on one's world view or personal paradigm (Bailey, 1997; Hughson, 2000; Lincoln & Guba, 1998; Mertens). Sire (1988) agrees and writes that "to be fully conscious intellectually we should not only be able to detect the world views of others but be aware of our own -- why it is ours and why in the light of so many options we think it is true" (p. 11). The last phrase of Sire's quote suggests that a full debate will occur within this paper. Such is not so; other excellent resources better accommodate that topic (Erickson, 1989; Lincoln & Guba, 1998; Mertens; Sire). This section simply highlights the belief system that the researcher holds and why a certain methodology was used to investigate the research question.

I believe that infinite variability and an underlying sense of order are basic principles in life. Within an open system, there are dependable foundations, recurring schemes, and patterns which can be demonstrated to be more or less mature than others. This makes it possible to determine if gains in specific human attributes / conditions are made over time. I also believe that no two objects, creatures, or humans are created the same, and that people have special abilities which make them unique from other living creatures and distinct from one another. The differences between people, for example, are extended

through variations in experiences, choices, actions, thoughts, and emotions. Human beings have autonomous personalities. These are characterized by self-determination, and the ability to be self-reflective and creative, and this results in a personal identity for every man or woman, boy or girl.

I also hold views about how people journey through life, the worth of individuals, and my own role in life. These views influence how I treat people, interact with them, and how I also expect to be treated. For example, I understand that people travel through life together -- yet very alone. Throughout this journey, we become aware of our differences, learn from one another, and at the same time can teach others. Information is communicated through the sharing of ideas, insights, and perceptions. Together humans work towards acquiring knowledge and finding truth. I also understand that humans are created equal, and therefore, all people deserve dignity, respect, and just treatment from others; likewise, they should treat others in the same manner. In addition, I recognize that my role in life is to find God's plan for my life and to follow that design so as to reach my fullest potential. At the same time, I desire to provide equal opportunities for others, so I choose to assist people in finding God's plan for their life and helping them fulfill their ultimate ability.

Since we learn from others and can teach at the same time, it is important, while seeking ways to assist others in their journey through life, to document strategies, ideas, or methods that seem helpful for some people some of the time. This is because these techniques, or adaptations of certain techniques, may assist others as well. However, in that each human is unique and very complex, a particular intervention may better suit one person to reach more of their potential than another. It would be unreasonable to expect one type of intervention or methodology to be the best for all people.

I also believe that one cannot determine exact cause and effect relationships when conducting research with people because of the dynamic interplay of many factors. These factors include combinations of one's interests, attitude, and motivation; personal experiences, knowledge, and understanding; and a person's character, nature, and free-will -- in conjunction with environmental forces played out within the three domains of behaviour. Even in this complexity, one may be able to determine what seems to influence a person in positive

ways by observing the person closely when they react or respond to various conditions, by consulting with that individual during the process, and / or by gathering information from others who know the person well. As information emerges and findings seem to reinforce each other, one may state with more assurance that certain procedures or interventions were beneficial. And so, my world view and thoughts about life provided me with a framework and methodology, to investigate and gain a deeper understanding of children's learning.

Applying the Paradigm to the Research Question

As part of my journey through life, in conjunction with my interests, background, and the desire to help others reach their potential, I wanted to study the "processes" involved in psychomotor skill acquisition, and learn "what it would take" to help children with Ds acquire fundamental motor skills. It seemed that the most appropriate way to investigate this would be to focus on the personal experiences of each child: watching their responses during gross motor play, observing their reactions to various interventions, and asking parents to document their child's motor related behaviours at home during the research period. I sensed that by gathering information in such ways, I might be able to learn if and how children's participation in social exchanges enabled them to construct psychomotor concepts and understandings.

I was fully aware that when studying this topic, changes in motor behaviours would probably be evident through performance differences. These "product" differences would be interesting to document in some way as well, but they were not to be the focus of study. Following is how the research project developed and was conducted.

Goals

The main goal of this research was to investigate whether the psychomotor domain of children with Ds was modifiable. Subgoals included comparing the responses of children with Ds to two different teaching approaches designed to influence gross motor skill acquisition within a dynamic assessment model, and investigating which intervention strategies resulted in more advanced understanding and performance of two gross motor skills.

Design

The investigation incorporated two intervention approaches for teaching sliding and jumping to each child within a determined time period and in a specific location. The intervention approaches included a GP teaching format, developed to influence the cognitive processes involved in motor learning, and the C&P teaching format which focuses primarily on physical aspects of gross motor skill acquisition. Attention was given to two motor activities so as to focus in depth on various aspects of these rather than a few aspects of multiple motor tasks, and because the pilot study revealed children were interested in sliding and jumping but they were not yet performing these skills independently using mature forms and postures.

The design included three distinct periods: (a) a pre-intervention phase permitting observation of baseline skills; (b) an intervention phase; and (c) a post-intervention phase, which allowed for close observation of the child's responses and performances following the different teaching approaches.

This investigation was conducted using a case study research design.

The Case Study Approach

There are many advantages to using a case study approach. Whether used to describe, interpret, or evaluate, it permits a gathering and analysis of data gained through close observation of people in various settings when studying a particular phenomenon (Bailey, 1997; Creswell, 1998; Martens, 1998; Vogt, 1993). The case study approach facilitates data collection using multiple sources of information (Barlow & Hersen, 1984; Feagin, Orum, & Sjoberg, 1991; Yin, 1994) and enables one to conduct a more comprehensive investigation of issues, action, meaning, and / or events. Modifiablity of the psychomotor domain required an interdisciplinary focus since cognitive processes and physical action are blended within motor learning.

Rather than using results of one child to determine modifiability of the psychomotor domain, this study compared multiple cases. Replication of a research procedure with two or more subjects allows one to test theoretical perspectives with each child, and it establishes "greater generality for the data among individuals of a population" (Bouffard, 1993, p. 381). The case study

approach allows for duplication. If more than one case is used, the research design is referred to as a "replicated" or "collective" case study. When using duplication, one generally analyzes the results of individual cases first and then looks for similar patterns among the cases using a "cross case analysis". Cross case analysis is valuable since, although individual findings may reveal specific trends, if a collection of individual cases also shows the same trend, stronger claims may be made about the benefits of certain interventions or about other issues investigated. As a result, study findings may facilitate and encourage changes and innovations in theories, practice, and other related issues.

The case study approach is also considered a valuable way "to test the effectiveness of a specific instructional strategy" (Mertens, 1998; p. 146). The pilot study had already confirmed that a detailed observation of individual children provided rich information about their responses to various instructional strategies. Therefore, it was decided that the best way to study modifiability of the psychomotor domain would be to document behavioral responses of individual children before, during, and after their participation in two different teaching formats, within a natural setting (i. e. playground). Along with this definite setting, a public location which required prior scheduling arrangements, there was a definite beginning and end to each child's participation in this project. Creswell (1998) and Bresler (1994) reports that the case study approach is best suited to meeting the needs of time and context boundaries.

It was also decided that information about each child would be collected in numerous ways. This was done because different data collection methods provide additional and unique details about each child (Baine, 1996), and when examined collectively, multiple sources of information generally produce a richer picture of each child's responses and activities and this permits triangulation of data.

To enhance credibility with researchers in other disciplines; the desire to communicate with relevance and meaning to parents, practitioners, and others; and to validate observations, it was also felt that some data should show how and what motor performances were influenced as a result of the interventions used. Fortunately, the case study research design encourages one to use multiple sources of data. This permitted the use of categorization, tallies, and

other quantitative data to show subtle changes in complex motor skills. This data helped substantiate qualitative findings (Bailey, 1997). There are benefits in blending qualitative and quantitative research strategies in one investigation (Bailey, 1997), and according to Martens (1998), such mergers are possible. Dual methods complement each other by: compensating for limitations in each design, adding power to findings, helping one gain a greater understanding of a particular phenomenon by uncovering different dimensions and techniques, strengthening the study findings, and facilitating the triangulation of data -- since it "confirms information about a phenomenon to obtain convergent validity -- confidence that a finding is valid because it has been confirmed by more than one method" (Bailey, 1997, p. 38).

In order to strengthen the rigor of the case study approach, specific methods and strategies suggested by Yin (1994), Creswell (1998), and Feagin et al. (1991) were implemented. For example, to reduce subjective judgments and bias of the researcher, data was collected using multiple sources, a chain of evidence was constructed for each participant, and four parents reviewed documentation of their child's participation in the project. All research methods and procedures were documented in great detail, referred to continually, and followed closely. As much as was humanly possible, individual cases were replicated in the same manner for each child.

Sample

Criteria for Sample Selection

The following criteria was used to select participants for the project:

- children with Ds aged 30 to 66 months, and
- children who were unable to, or who experienced some difficulty while sliding and / or jumping independently.

Recruitment of Participants

An invitation to participate in the research project was published in and circulated to members of a support group for parents with children with Ds, using their May and June 1999 newsletters. (See Appendix 1). Over a period of four months, seven families responded to the newsletter article by telephone.

Additional details about the research project were presented to each family as required. Only when all questions were answered to the parent's satisfaction regarding the nature of the project and the required involvement, were they asked to sign copies of the informed consent form (See Appendix 2).

Five girls and two boys with Ds participated in the study. Based on the day they entered the study, children ranged in age from 2 years 10 months and 2 days, to 5 years 9 months and 15 days, with a mean age of 4 years 0 months and 23 days.

Procedures

After consent forms were signed, a schedule of attendance was worked out with each family. This was based on their availability and when staff at the play-ground felt research activity would be suitable. Data was collected over four months, but with the exception of one child[1], each participant only committed to eleven consecutive days, coded as "Day One" through to "Day Eleven". This time frame was adopted since it was a consistent way to document each child's participation in the research process. The eleven day intervals were different for each parent-child pair because families joined the research at different times.

Research was conducted in three phases (a) a pre-assessment, (b) the intervention / dynamic assessment session, and (c) post-intervention period. Research activities proceeded on the days, in the locations, and using the specified assessment techniques described in Table 1.

[1] A one month extension was permitted to accommodate the needs of one child who fractured her foot at home on Day Six. She was not active in the research activities at the time. Medical advice was to reduce physical activity and weight bearing for a minimum of four weeks, hence, the extended time allotment.

Table 1.
Days, Locations, Assessment Measures, and Manner in Which Data was Collected

Days	Location	Assessments	Data Collected Via:
		Pre-Assessment Period	
Day 1	Participant's Home	1) Child's Artwork 2) Parent Interview	1) Child's drawings 2) Audio records & transcription 3) Four photographs per child*
*These photographs were taken to create laminated paper dolls needed for intervention period.			
Day 2	Indoor Playground Separate Room	1) Spontaneous movements of child 2) Parent request for child to slide & jump 3) Questions for parent	1) Floor plan / map of playground 2) Video record of child's behaviors 3) Parent interview responses 4) Parent journaling
		Intervention / Dynamic Assessment Session	
Day 3	Separate room at Indoor Playground	1) Command & practice teaching 2) Graduated prompt form of dynamic assessment	1) Video record of researcher/child interactions and child's behaviours 2) Parent journaling
		Post-Assessment Period	
Day 3	Separate room at Indoor Playground	1) Post intervention tasks	1) Video records of child's behaviors 2) Child's productions 3) Parent journaling
Day 4	Separate room & Indoor Playground	1) Spontaneous movements of child 2) Slide/jump request	1) Floor plan / map of playground 2) Video records of child's behaviors 3) Child's productions 4) Parent journaling
Day 5 to 10	Parent's home	1) Parents observe child's motor behaviors	1) Parent journaling
Day 11	Indoor Playground Separate Room	1) Spontaneous movements of child, 2) Slide/jump request 3) Questions for parent	1) Floor plan / map of playground 2) Video records of child's behaviors 3) Child's productions 4) Interview responses 5) Parent's journal handed in

Pre-Assessment Period

At participant's home.

On Day One, research participants were visited in their homes to begin data collection and so children would get to know the researcher. During the visit, children were asked to draw three pictures; parents were interviewed on audio-tape about their child's current gross motor competence (Refer to Appendix 3.1.) and asked to journal their child's spontaneous sliding and jumping related activities during the research period; and four photographs were taken of each child. The children's drawings were conducted to establish baselines showing that they: understood verbal instructions, the concept of drawing, and were able to portray in graphic form someone sliding down a slide and someone jumping.

Within the day, interview data was identified with a pseudonym, transcribed, and raw data was destroyed. The four photographs were used to construct two "laminated paper dolls" of each participant (See Appendix 3.4. for an example). Each doll had movable arms, legs, trunk, hips, and head; one doll featured a front / back view, and the other doll displayed a left / right side view.

At the playground.

On Day Two, research commenced at the main research site, a large indoor playground. Parents were invited to participate in data collection, however, most declined for various reasons. During the one hour session, children were observed in free-play; their movements were video-taped and documented on a floor plan / map (See Appendix 3.5.). Documentation on the floor plan / map included (a) marking lines indicating the child's patterns of movement on and in the playground, (b) identifying the child's location on the playground with a specified mark every three minutes, and (c) by writing notes of observed motor behaviours. This data provided information about the various activities each child performed and the time spent at different locations while on the play-ground equipment. The video tape provided a permanent record of the child's motor behaviours, substantiated data recorded on the floor plan / maps, and supplied additional information about the child's self-initiated activity that may have been missed while writing and recording details on the map. Collectively, the video tape and floor plan / map data established a baseline measure of the gross motor behaviors of preschool aged children with Ds before intervention.

In the event some children did not perform, or it was difficult to observe their attempts at sliding and jumping in free-play, all children were asked to jump and slide on additional pieces of equipment in an intervention room adjacent to the playground.[2] This was to ensure a clear view of the baseline measures of these skills and to document teaching techniques parents used with their children. Parents and children were observed and videotaped at this time.

Substantial knowledge of various fundamental motor skills and their components had been acquired through the study of physical education and an exhaustive review of the literature. Correct age-appropriate performance standards of sliding and jumping were documented so that each child's competency of sliding and jumping could be judged according to certain criteria (Burton & Miller, 1998; Wessel & Kelly, 1986). Watkinson and Wall (1982) state that it is important to establish the degree of proficiency desired in target skills; Wessel (1980a) writes that one must be able to "visualize the correct performance of each component of the skill" (p. 20). Wessel suggests that for preschoolers, one "practice by watching children at play. Learn to recognize the focal points or components of each skill prior to assessment" (p. 20). The researcher had been trained in this field and observed children's movements formally and informally for over twenty years. Therefore, based on Burton and Miller's (1998) view that practitioners who have been well trained should be able to rely on their own observations of the movement behaviors of individuals in functional and naturalistic settings, without feeling like they need to translate the behavior into a numerical system (p. 332), each child's current sliding and jumping ability was rated according to a checklist which was based on a "normal developmental sequence" (Baine, 1996, p. 9). Burton and Miller add that even though this judgment based approach "does not involve true assessment or measurement, it may be more valid" (p. 332) than other assessment strategies in certain situations; because, such evaluations permit one to collect, structure, and quantify impressions that professionals / caregivers have of a child's characteristics.

[2] A small plastic slide, mini trampoline with a support bar, and a larger trampoline were used in the intervention room (See Appendix 6. for pictures)because: 1) the pilot study revealed that some children seemed frightened of the large playground equipment, 2) to reduce fatigue from moving back and forth to the intervention and activity sites, 3) to reduce disruptions caused by the research activities at the playground; and 4) to determine if taught motor skills were used spontaneously on other pieces of playground equipment in the days that followed intervention.

As is common in the field of motor assessment, the aspects of motor skills judged were based on / adapted from assessment criteria and related concepts provided by sources who have documented stages children progress through while developing fundamental motor skills (Burton & Miller, 1998; Folio & Fewell, 1983; Seefeldt & Haubenstricker, 1982; Sherrill, 1993; Stott, Henderson, & Moyes, 1986; Watkinson & Wall, 1982; Wesell, 1980a, 1980b; Wickstrom, 1983). Their research makes it possible to determine the maturation levels of motor skills. The desired performance standards included:

1) Sliding: sitting upright, facing forward, and leaning slightly ahead; legs apart and pressed against the edges of the slide; hands holding firmly onto the edge of the slide continuously during the descent; balanced landing.

2) Jumping: standing upright on chosen surface; preparatory crouch with hips and knees bent and arms flexed and extended to the back; upward motion of body with simultaneous upward arm thrust; straight leg position at highest point of jump; and balanced landing on feet.

At the end of the free-play session, parents were interviewed again, asking for their perceptions of their child's gross motor activity at the playground and about the teaching techniques they used when requesting their child to slide and jump in the intervention room (See Appendix 3.2.). Before parents left, they were reminded to fill in their journals. After each pre-assessment session, additional notes were made on the floor plan / maps about each child's activities, parental responses, and general conditions of the day.

Intervention During Dynamic Assessment

On Day Three, each child participated in two different teaching styles, the GP format and the C&P format. Separate procedures for sliding and jumping were developed for each teaching style, therefore, four combinations were available. The order of teaching sliding and jumping, and the type of teaching style used, was randomized by asking each parent to pick a number out of a "hat". The number picked corresponded to the teaching style used for the different skills (See Table 2). The parent was asked to leave the intervention room for the remainder of the session so he / she would not observe which skill was taught with which format.

Table 2.

Order of Intervention and Specific Motor Skill Taught

Number in Hat	First Activity	Second Activity
#1	Graduated prompt (sliding)	Command & practice (jumping)
#2	Graduated prompt (jumping)	Command & practice (sliding)
#3	Command & practice (sliding)	Graduated prompt (jumping)
#4	Command & practice (jumping)	Graduated prompt (sliding)

Intervention began soon after the parent left the room and was recorded on video tape. The teaching instructions are presented in Appendix 4.

Command and practice format.

The C&P teaching format is typically used on children with Ds in motor learning experiences (Block, 1991; Dmitriev & Oelwein, 1988; Sherrill, 1993; Watkinson & Wall, 1982; Wessel, 1980a; Winders, 1997). Therefore, to establish a form of control, one motor skill was taught using this method (See Appendix 4.1. for scripts). Each child was instructed exactly how to perform the specified motor skill using verbal instructions only, and the commands were presented six times. The researcher offered physical guidance if the child required or requested assistance to perform the skill. No demonstrations were given. After the trials were finished, the child began a five minute free-play session in the intervention room which was also video taped. The free-play session provided a short break for the child and permitted close observation of each child's immediate behaviours / responses to the teaching style they had just participated in.

Graduated prompt format.

In conjunction with the parents involved in the pilot study, six prompts were developed as a way to influence the cognitive processes involved in psychomotor learning and development. Initial prompts were abstract, but following ones became more concrete and three dimensional. The various prompts are recorded in Table 3. Details about how each prompt was presented, and the corresponding verbal instructions are available in Appendix 4.2.

Table 3.

Level of and Description of Prompts used for Sliding and Jumping Interventions

Prompt	Sliding	Jumping
1	Poster of the slides at playground	Poster of jumping room at playground
2	Cartoon character sliding	Cartoon character jumping
3	Picture of child sliding	Picture of child jumping
4	Front view laminated doll	Side view laminated doll
5	Manikin and paper tube slide	Manikin and small pillow
6	Demonstration by human adult	Demonstration by human adult

After each prompt was presented, the child was asked to "show" the motor skill. This procedure continued until the child participated in all six prompts. Immediately after all the GPs were administered, a five minute free-play session began. Again, this permitted a short break for the child and permitted the researcher to observe the child's activities and responses to the intervention. This was also videotaped to permit further study and close observation of each child's responses.

It should be noted that six practice / performance tasks were planned for each teaching format, in order to remain consistent in the number of trials.

Post-Assessment Period

This period involved different aspects, all of which were videotaped.

Five minutes after each intervention session.

Immediately after each five minute free-play session, the child participated in several tasks related to the motor skill they had just performed. The tasks developed were based on findings of the pilot study and designed to measure the child's cognitive understanding of the targeted motor skills. The tasks are presented in Table 4 and scripts are documented in Appendix 5.1.

Table 4.

Order and Description of Post-intervention Tasks

Tasks	Sliding	Jumping
1	Draw a picture of someone sliding using paper and felt markers	Draw a picture of someone jumping using paper and felt markers
2	Choose one of four pictures "Who is sliding?"	Choose one of four pictures "Who is jumping?"
3	Create proper sequence of sliding motion, using four cartoon cards	Create proper sequence of jumping motion, using four cartoon cards
4	Choose one of four pictures "Who is not sliding?"	Choose one of four pictures "Who is not jumping?"
5	Display sliding action using a manikin and paper tube slide	Display jumping action using a manikin and small pillow

After each child participated in both teaching styles and answered all post-intervention tasks, they were permitted to play until their parent arrived. Before leaving with their child, each parent was reminded to journal any sliding and jumping related activity or behaviour.

One day after the intervention session.

On Day Four, the child returned to the research site for a one hour free-play session. The child had access to all teaching and assessment tools, the equipment in the intervention room, and the large playground. Their self-initiated activities were recorded by video tape and on the floor plan / map. The data gathered was used to establish psychomotor behaviors of each child after the intervention period, look for transfer of skills from small to large equipment, and determine whether the child revisited any intervention or assessment tools.

One week after the intervention session.

To see if psychomotor behaviours had changed / remained the same after intervention, a final free-play session was conducted with similar conditions to those on Day Four. Once the 60 minute session was complete, parents were interviewed again (Questions in Appendix 3.3.) and their journals were gathered.

Data Analysis

The main method of analysis was triangulation of data within each case and among the seven cases studied. This was accomplished by: closely observating each child, purposefully interacting with research participants and their parents during the study, collecting and comparing multiple sources of information throughout the project, clarifying children's responses with their parents, reflecting on individual findings, consulting with others about certain patterns, and revisiting the data collectively to establish final outcomes.

Much raw data was generated. This included 35 drawings (5 per child), 24 floor plan / maps (3 per child, plus 3 drawn by parents), 21 interview scripts (3 per child), over 20 hours of video tape, seven journals (one per parent), and 167 pages of detailed notes. Analysis began as information was being gathered on each child, for there was an already established need to "make sense of it" (Bailey, 1997). When all the data was collected on each child, a thorough review of the various aspects of each child's case was conducted, and then cross case comparisons were made. Table 5 displays assessments used, the form of data collected, and how the data was analyzed.

Table 5.

Analysis of Data Collected from Various Assessment Measures

Assessments	Data Collected Via:	Analysis
	Pre-Assessment Period	
1) Children's Artwork	1) Drawings	Art appraisals
2) Initial interview with parent	2) Transcription of parent's answers	Descriptive
3) Spontaneous movements of child	3.1) Floor plan / map of playground 3.2) Video record of child's behaviors	Categorization, tallying, and descriptions
4) Second interview with parent	4) Transcription of parent's answers	Descriptive
5) Parent/child interactions & request for child to slide & jump	5) Video records of child/parent behaviors	Descriptive
	Intervention Period	
1) Interaction of researcher and child	1.1) Video record of interactions and child's behaviors	Descriptive and quantification
	Post-Assessment Period	
1) Immediate post intervention tasks	1.1) Video record of child's behaviors	Descriptive
2) Spontaneous movements of child	2.1) Floor plan / map of playground	Categorization, tallying, and descriptions
	2.2) Video records of child's behaviors	Descriptive
3) Questions for Parents	3.1) Written responses	Documentations
	3.2) Parent journals	Documentations

Note: Additional data was collected throughout the research period using anecdotal notes. These were descriptive in nature and used only to add richness / a depth of understanding to other data.

The Process and Analysis of Qualitative Data

Because knowledge gained in qualitative research is a human construction, it is impossible to discover reality for each participant. It is also impossible to claim that others would make sense of the research data in the same way. However, as Bailey (1997), Bresler (1994), Creswell (1998), and Mertens (1998) suggest, the analysis of personal observations, descriptions, answers to

questions, and the documentation of various findings, along with the insights and experience of parents, did result in ponderings and interpretative understandings. Research findings did not emerge immediately; initial impressions were documented in personal notes and reflected on until all data was gathered. Thereafter, the data was divided into smaller meaningful units that permitted a closer inspection of each segment. Early findings seemed to "fit" several general categories. However, as successive details were gathered and integrated in a systematic way, in consultation with others these categories were modified and refined to better suit the data. Member checking was conducted with four parents to ensure accuracy of the reported findings and agreement of the interpretations. In general, information was scrutinized in the following order.

Phase One

Video tape records of the one hour free-play sessions at the playground were compared with floor plan / map documents. If inaccuracies existed, these were rectified. Most often, activity observed in the video had been omitted on the floor plan / map, and, when this occurred, information was added in the proper location on the map. Next, information from the video tapes and floor plan / maps of each child were transcribed, documented into text, and saved in data banks. These notes were descriptive accounts, purposefully rich with details, and included an objective record of each child's overt behaviours, the researcher's interpretation of each child's vocalizations, parent responses, and other related activities during the research period.

Phase Two

The floor plan / maps of each child, were initially examined for sliding and jumping related activities; then analyzed for general patterns of motor activity, the amount of time each child spent in various locations at the playground, and recording the different types of activity each child participated in.

Next, the three floor plan / maps for each child were compared for changes in patterns of physical activity over the short research period. Analysis included examining whether the child initiated more spontaneous sliding or jumping related behaviours over the research period, and if the skills engaged in, more

closely represented mature patterns of sliding and jumping after participating in the different forms of intervention presented in the dynamic assessment. In addition, the three floor plan / maps were studied to see whether the child attempted or performed skills and activities not tried before.

Floor plan / maps were also assessed for the amount and type of sliding and jumping related activities that occurred during each free-play session. Initially motor behaviours were divided simply into sliding related behaviours and jumping related behaviours, however, several children did not display jumping and sliding activities during the research sessions. What emerged from the data was that some children were displaying precursors or showing other activities which were related to sliding and jumping behaviors. As a result of this closer inspection of each child's motor activity and form, and in consultation with others (some aware and others unaware of the research goals), responses related to sliding and jumping were categorized along a continuum of behaviours, into six "progressive" levels on a checklist. This made it more possible to note subtle changes in motor behaviour (Refer to Table 6).

The six levels recorded in the checklist, include qualitative differences in sliding and jumping related behaviours which were exhibited by all the children during the research project. Each "level" of the motor skill was clearly described so as to reduce any rating error. The "lowest" level was established to document that while a child may not have had an ability to perform sliding and jumping, they did touch, handle, attend to, play with, or in other ways show an interest in the motor skill (Wessel, 1980b). The need to document the child's interest in various motor skills became evident from the data gathered on some of the younger children involved in the study and supports suggestions made by Dunn (1997), Sherrill (1993), Stephens (1971) and Watkinson and Wall (1982) that "interest" is valuable information worth recording. Other levels in the checklist created for this research project describe various precursors to and forms of assisted or independent sliding and jumping. These checklist categories were developed as variations / adaptations of multiple motor assessments documented or used previously (DiRocco, Clark, & Phillips, 1987; Folio & Fewell, 1983; Linder, 1993; Morin & Reid, 1985; Seefeldt & Haubenstricker, 1982; Stott et al, 1986; Sherrill, 1993; Watkinson & Wall, 1982; Wickstrom, 1983; Wessel, 1980b).

Table 6.

Categories of Free-Play Motor Skill Activity Related to Sliding and Jumping

Category	Sliding Behaviours	Jumping Behaviours
A:	Glance toward, a visit to, play in, or play near sliding equipment; watching peers descend the slide; and / or each recognizable word used related to the activity ("wheee, slide, go down").	Glance toward, a visit to, or play on the jumping equipment; watching peers doing jumping activities; and / or each recognizable word used related to the activity ("jump, bounce, up, down").
B:	Any elementary sliding activities such as bum scoots / slides; forward or backward stomach glides; and other sliding-type body motions; performed with or without the support of others.	Any precursors related to jumping such as an up / down motion made by the body or parts of the body, bum or knee bounces, forward falls, one foot step downs.
C:	Any forward sitting sliding motion with support or assistance - the position of legs and arms were not considered important.	Any supported up / down motion which resulted in lifting the feet slightly off the ground, and bending the knees or moving the arms upward or outward.
D:	Any independent forward sitting motion which involved positioning the legs apart or placing the hands on the slide's edge.	Any independent up / down motion which resulted in jumps of 1-2 inches, & bending knees or lifting arms up / out.
E:	Any independent forward sitting posture with legs apart and arms in proper position on the slide's edge.	Any independent up / down motion resulting in two feet coming distinctly off the ground to a height of 2.5-5 inches, with bent knees & arms in a up or outward position.
F:	Any independent daring activity seemingly related to sliding; such as sliding down while laying forward on one's stomach, lifting arms directly above head while sliding, or sliding in other unusual ways.	Any independent daring activity related to jumping, such as jumping off 'higher than normal' objects, jumping off objects not normally connected with jumping, or jumping in wild and twisty ways.

Note: The activities were coded according to the various levels whether performed physically by the child or by manipulating the teaching / assessment tools.

Rationale for using checklist format to judge changes in gross motor ability.

Numerous rating scales and standardized tests exist for assessing motor skill development in young children, and Burton and Miller (1998) provide an extensive overview of these products. However, the typically used norm or criterion referenced assessments were not approprite for this research project, because research has already proven that children with Ds are significantly delayed in their motor development when compared with age related peers, and results of formal testing procedures do not generally yield typical measures of motor performance. Observations made during free-play are more representative of a child's current level of functioning (Morin & Reid, 1985; Watkinson & Wall, 1982; Wessell, 1980a). In addition, Zimmerman (1994) suggests that a student's work / ability should be judged against their own previous work / ability rather than traditional standardized criteria.

However, when determining if youngsters are truly learning (i. e. can remember and repeat new motor tasks), some method of recording a child's progress should be used (Eichstaedt & Lavay, 1992). They suggest using a prescriptive / diagnostic / teaching progression list with specific criteria such as is included in the I CAN Program (Wessel, 1980a) and in the PDMS (Folio & Fewell, 1983). Unfortunately, these tests do not assess minute differences in motor skill ability that are needed for this research project. The I CAN inventory uses a simple "pass" or "fail" grade for various aspects of the motor skills listed, while the PDMS uses a three point rating scale to judge a child's motor response on a list of predetermined tasks. The way to judge differences in sliding and jumping related behaviours offered by Wessel and Folio and Fewell, were too restrictive for the purposes of this research and such criterion referenced tests were simply not suitable for measuring free-play activities.

Several assessments have been developed that gauge a preschool-aged child's gross motor behaviour during free-play. These include checklists in the I CAN Preprimary Motor and Play Skills Program (Wessel, 1980b), the Transdiciplinary Play Based Assessment (Linder, 1993), and the PREP Program (Watkinson & Wall, 1982). However, even though all three assessment forms used various "levels" to assess a child's motor ability, they were also considered unsuitable and therefore adapted to fit the needs of this research

project. For example, the PREP Program Free-Play Inventory (Watkinson & Wall, 1982) lists multiple target skills, each sub-divided into two to four general sub-skills (i. e. Target skill: Sliding Down a Slide: 1. Slides on seat; 2. Slides on tummy feet first; 3. Slides on tummy head first.). These three sub-skills do not document aspects of arm or leg action when sliding and are to be "checked off" if tasks are performed twice within one minute observation periods. In addition, although the stated intent is to observe the child in free-play, teachers are to record if the child required verbal, visual, physical, or no prompts during free-play! The I CAN Free-play Assessment (Wessel, 1980b) seems contradictory as well, since teachers are to offer verbal requests, guidance, demonstrations, suggest games, use action words, and other forms of assistance, which will assist the child to participate in free-play. The I CAN performance score sheet is quite varied in free-play behaviours, however, several categories are very general, and scores are marked with "achievement" only after the child has responded three times in the same manner with various objects and / or pieces of equipment within a 15 minute period. There does not seem to be any concern about how the child moves while on the equipment. The Transdisciplinary Play Based Assessment (Linder, 1993), frequently used with pre-schoolers, does not include sliding down a slide as one of the motor skills to be assessed; the categories for jumping are extremely general in their descriptions, and the focus in jumping ability is based on foot action only -- not considering other maturational aspects of the motor skill, such as arm action, posture, knee and hip flexion. So, most descriptions of the free-play motor skill assessments were too general, while other accomplishments seemed too restrictive (needing two or more similar responses of the same motor activity within the time allotted). Because the goal of this research was to look for any positive change or emerging skill, in the gross motor behaviours of the children with Ds as a result of the various teaching interventions, the measurement criteria during free-play needed to be much more detailed and specific.

Folio and Fewell (1983) report that examiners will be able to "recognize when the child's performance on a task merits some credit but does not fully meet the given criterion" (p. 14). Burton and Miller (1998) also state that although "observations of movement professionals have been used in the

criterion-related validation of test instruments; [these observations] have not been carefully considered as a viable approach [to movement assessment] in themselves.The strengths and weaknesses of professionals using their observations to make program judgments need to be considered more carefully" (p. 332). Others (Morin & Reid, 1985; Sherrill, 1993; Stott et al., 1986) have created checklists with descriptors to assess differences in certain motor skills; this was done by adapting information from other assessments to create their own qualitative assessment device. DiRocco et al. (1987) qualifies aspects of jumping for distance in various levels, describing in great detail the types of arm and leg action that is generally evident in novice to more mature patterns of jumping. Such procedures were also adopted for this study. Six levels were developed to assess minute differences in the children's jumping and sliding abilities. Numerical scores were not given to the various categories of the checklist; each level simply described various aspects of sliding and jumping that were observed throughout the research project. Gains in the maturation level of a motor skill were considered as giving an indication of modifiability of the psychomotor domain (DiRocco et al, 1987).

Once each child's motor behavours were analyzed and scored according to the various descriptors in Table 6, their responses in each level were counted, recorded in tabular form, and then compared over the three one hour free-play sessions.

Phase Three

The activities and responses of each child during the dynamic assessment session were analyzed. Detailed notes and descriptions were developed by observing video tapes and converting visual images into written text. To maintain a clear understanding of the child's responses to the different teaching formats, notes and descriptions included activities observed during the teaching phase, the five minute free-play period, and the post-intervention tasks which were conducted immediately after each teaching format. The responses of each child were reviewed and examined to determine if one teaching format appeared more effective than another for gross motor skill acquisition, or if one teaching style had other effects on each child.

Phase Four

Since parents are a rich source of information about their child (Baine, 1996; Bricker & Widerstrom, 1996; Burton & Miller, 1998) parent's perceptions about and observations of their child were included in this study. Their involvement in the research project was examined by reviewing their: interview responses, interactions with their child during the sliding and jumping request, journal entries, and spontaneous remarks which were written on the floor plan / map. Parent responses were reviewed and compared with observed data and this was used to strengthen or refute findings. For example, parent descriptions of their child's gross motor proficiency were compared to baseline skills displayed by the child, and parent self-reports of how they taught motor skills to their child were compared to the video taped record which showed each parent interacting with their child. The findings were described for each case and upon occasion some parent responses were used to highlight surprising results.

Phase Five

Once individual sections of each child's case were analyzed according to phases described above, each case was reviewed in its entirety. This was done to assess if: changes in psychomotor behaviours occurred over the research period, one teaching strategy appeared to make a difference in motor learning and development, and any other patterns existed. During this time of review, four parents were asked to read their child's case study notes inorder to establish a concise, accurate, and objective description of their child's involvement, proper documentation of the chain of events, and if any errors or omissions existed. Two parents found small errors in the text -- a few spelling errors, and one instance where the child's real name was used in place of the pseudonym. However, all four parents reported that cases were described as they remembered, all known facts were accurate, and their child's behaviours were detailed properly and with enough description.

The immense volume of data from the case studies was too great to include in the results section. Therefore, only a few responses of each child were used as exemplary samples in the following chapter. The examples chosen are interesting and "out of the ordinary" responses, that seem to

demonstrate how cognitive processes influenced motor behaviour. The events described may have occurred during free-play sessions, the dynamic assessment sessions, or at any other time when the child was with their parents but away from the research site during the research period.

Note about the children's drawings.

Children need various forms of expression, and literature demonstrates and supports the use and value of encouraging artwork for children with developmental delays (Golomb, 1996; Golomb & Schemeling, 1996; Klager, 1996). For example, artwork is said to provide ways for children to communicate ideas (Lindsay, 1972), create models of their realities and serve as a symbolic language (Gamradt & Staples, 1994), tell stories (Ishii, Ishii, Ishii, & Sugiyama, 1996), and provide a window into the child's mental life (Winner, 1996). Lund (1994) adds that artwork -- such as drawing -- may assist children to "explore, clarify, and document their interests speculations, and ideas" (p. 20), and therefore, functions as an "idea-keeper".

To accommodate artwork as a form of communication, the children involved in the pilot study and in this project, had been asked to draw pictures of people sliding and jumping. The children in the pilot project were simply asked to draw a picture of "someone sliding down a slide" after participating in sliding and they were asked to draw a picture of "someone jumping up and down" after jumping on the equipment in the playground. These children produced drawings unlike others their parents had seen before (Personal communications with the pilot study parents, November 2 & 23, 1998, & December 11, 1998). This interesting finding was to be replicated in this study.

It was suggested that another way to assess differences in drawing ability would be to ask each child to draw a picture of sliding and jumping before and after they participated in the various motor tasks. This was done to determine if any changes in their understanding or expression of the various motor behaviours had changed as a result of the C&P or GP teaching methods. Two children's art specialists served as neutral appraisors for the drawings constructed as part of this project. However, they were unable to ascertain any differences in: the subject of each picture and / or the quality of baseline artwork and drawings produced after the two different forms of intervention. Neverthe-

less, several parents noted spontaneous drawing activity by their children during the week that followed the intervention; these examples are referred to in the individual case studies documented in the following chapter.

Phase Six

Once all seven cases were reviewed individually, cross-case analysis occurred by comparing each child's findings with all other cases. This analysis was conducted to answer research questions, confirm patterns of changed gross motor activity before and after the intervention session, determine whether certain teaching strategies seemed more effective than others in teaching gross motor skills, and thereby, ascertain if the psychomotor domain was modifiable.

As a result of cross-case analysis, additional patterns emerged. These findings are presented in Chapter Five.

CHAPTER FOUR
INDIVIDUAL RESULTS AND INTERESTING FINDINGS

Introduction

A brief explanation of the research setting is followed by descriptions of the behaviours of seven preschool aged children with Ds who were studied while investigating modifiability of the psychomotor domain. A discussion follows each illustration. What becomes evident is that for the most part, the traditional motor theories and approaches are unable to explain chnages in the children's psychomotor behaviours.

Context of the Cases

All cases were conducted in a large metropolitan center known for its great sense of community spirit and pride. The city has numerous resources available for special interest groups. For example, it offers many services for people with Ds. Generally parents with young children with Ds send their sons / daughters to a specialized preschool which focuses on speech and language development. Parents are also encouraged to place their children with Ds in integrated and inclusive educational settings such as community play schools and grade schools. There are very limited services available for preschool aged children with Ds to learn and develop their gross motor skills. Upon occasion, one may see a young child with Ds in a community setting which focuses on physical activity, such as a swimming pool, recreational gymnastics program, or a playground to which their parents or siblings have brought them.

Because winters are long and cold in this city, several large indoor play-grounds have been established. These "fee for entry" playgrounds are popular play spots for parents and children. The indoor playground used for this study contains many big, bright, colorful, interesting pieces of equipment such as slides, tunnels, ramps, stairs, ball pits, hanging baffles, rope nets and mesh, as well as a zip line, jumping room, and numerous platforms and ledges. Built with an eye for safety, all posts and frames are padded, and large nets are hung, or other dividers are positioned between various play areas so children will not run haphazardly into other locations. There are distinct entry / exit locations for the various play spaces. The play area extends upwards from ground level to a

large second level, and two locations in the play area also have a third level play area. These are on opposite ends of the play equipment, and serve as top sections of two very long slides. In addition to the main play area, there is a separate baby / toddler area which has similar play equipment, wall climbing area, an arcade, and a food court. This indoor playground also offers birthday party specials; to accommodate this, they have six separate party rooms at one end of the play area. The largest room, typically used for equipment and garbage storage, became the "intervention" room. Supplies and equipment were set up on a daily basis as needed, without interference from others. Although there is an admission fee required to enter the playground, parents and children participating in this research did not pay it.

The following section provides information gathered from the seven children involved in the study; each child's case is presented in order from youngest to oldest. Background information about each child is presented initially, and, for reading convenience, excerpts of raw data or case study notes are indented and italicized. Only two or three highlights of each child's psychomotor behaviours have been presented to reduce lengthy descriptions, and, because similar responses and activity were observed in several children. The descriptions are rich with small details, however, it is presented this way, so the reader may develop a picture of the child's activity, come to understand the process the child was engaged in at the time, and have description of enough depth with which to judge the plausibility of the interpretation.

It is impossible to conclude that certain interventions lead to specific outcomes in a cause and effect relationship. Therefore, inferences, based upon responses which were observed, heard, or documented in other ways, are offered. Discussions related to various theories and other support from the literature will be woven throughout this section.

Welcome to a world of movement intervention, assessment and interpretation!

Individual Cases

Carol

Carol, a little blonde girl, was 2 years, 10 months, and 2 days old when she entered the study. She has two brothers, one slightly older and one slightly younger. Monique, Carol's mother, reported that Carol had been walking since she was two years of age, was cautious in her gross motor explorations and activity, and normally went down slides and stairs "on her tummy, feet first, like a backwards stomach slide." However, recently she was beginning to go down slides in a forward sitting position. Monique added that Carol tended to fall down or lay backwards while descending slides using this new form. Monique also mentioned Carol was unable to lift her feet while jumping, but she had been on a trampoline before. Carol's performance during the baseline activities corresponded to Monique's descriptions.

Carol was not observed sliding or jumping in typical forms during her free-play sessions. However, she used words and performed precursors to sliding and jumping. For example, her case study notes report

> *while moving about the playground during the pre-assessment session, Carol spontaneously said, "Down tummy" while she did several backwards stomach slides, and she said, "Down steps" just as she was preparing to do a small bum scoot / slide down the stairs. Carol also self-initiated the words, "Up, down" as she was making jiggling motions on the mini tramp, and she said, "Up, up" while climbing the stairs of the slide during the intervention session. Carol even used words to describe what she was doing with a doll, and this was noted during the post-intervention task for sliding. Carol was asked to display her knowledge of sliding using a paper tube slide and a manikin at a table. The first two times that Carol 'slid' the manikin down the tube slide, she said, "Whoooaaa" and, "Down". Then, immediately after the doll landed on the table, Carol readjusted the manikin's arms up and down several times, each time saying the words, "Up, down". During the post-assessment sessions, Carol was also heard talking outloud. She said, "Sit" as she prepared to sit on the top edge of the slide, "Bounce" when looking at and pointing to the trampoline, and, "Up, down, tummy, slide" as she crawled up and over a small ledge and slid down into the ball tarp area.*

Vygotsky (1978) reports that when young children attempt to achieve goals, they tend to use words and speak outloud; "As a rule this speech arises spontaneously" (p. 25). Vygotsky reports older children who use speech to

solve obstacles may "divide the activity into two consecutive parts. She plans how to solve the problem through speech and then carries out the prepared solution through overt activity" (p. 26). This results in speech production before problem solutions. However, Vygotsky reports that young children tend to fuse speech and action when responding to objects and / or social events, similar to Carol's responses.

"Learners talk to themselves!" (Cratty, 1973b, p. 56), because learners comment on descriptions that go through their mind, reports a physical educator who promotes academic learning through movement. Cratty notes that wide differences in quantity and quality of self-talk exist, learners talk and concentrate on different elements of movement at different times, and most often a learner concentrates on one aspect of a desired task. Cratty adds that the quantity of self talk generally decreases as motor skills are attained -- unless a plateau is reached. He writes that if a plateau is reached, this may be evidence that blockages are frustrating the learner, and therefore, other teaching strategies may be needed (1973a; 1975; 1989).

Others also recognize speech as an important component of learning motor skills. Schmidt (1991) writes,"Some learners engage in a great deal of self-talk, verbally guiding themselves through [motor] actions" (p. 173). He adds that speech is effective in initial stages of motor learning; it somehow facilitates a quick and rough skill approximation, but drops out later.

Fitts and Posner (1967) also comment about self-talk while acquiring motor skills. They believe learners go through various stages while learning motor skills, and several stages include elements of speech. They report in the initial phase, called the cognitive, learning, or 'verbal' phase, learners should be invited to use self-talk as a strategy to facilitate learning. Fitts and Posner also believe as one progresses through various stages of skill acquisition, self-talk becomes less frequent and possibly less necessary. Worringham et al. (1996) supports this, commenting that verbal and other cognitive strategies can facilitate learning of some psychomotor tasks, but, as skills are perfected, the need for speech is reduced or nonexistent.

Mosston and Ashworth (1994) do not address self-talk directly, but allude to it, for they encourage teachers of physical education to "listen to what the

learner is saying" (p. 107). Brown and Campione (1986) add that by listening carefully to children's spontaneous self-talk, others can learn much about a child's understanding of concepts or events. Starkes (1993) also refers to self-talk during motor skill acquisition. She reports self-talk may occur concurrently with task production or after, as a retrospective event.

Some view spontaneous self-talk as a strategy learners use when solving problems, while others believe self-talk should be encouraged during the learning of motor skills. However, since Carol was not asked to use speech, and speech was self-initiated, this illustration supports Vygotsky's (1978) belief that speech is a problem solving technique. And, because Carol's speech accompanied motor activity, Fitts and Posner (1967), Cratty (1973), and Schmidt (1991) would state she was in the initial phase of learning motor skills. Carol's case illustrates that she used a combination of vision, thought, speech, and action in motor skill production and performance.

Carol's self-initiated speech was also noticed by Monique. She mentioned that Carol was talking a lot at home. During the final interview, Monique said,

> *The amount of verbal walking through she is doing has been a big change, and the fact that she is saying the words has been a process change. But, just because it hasn't necessarily demonstrated itself through her [jumping] actions, doesn't mean she doesn't have it; it doesn't mean it's not clicking up there (Monique points to her own head).*

In the quote above, Monique referred to Carol's jumping actions. Over the short research period, Carol displayed remarkable changes in jumping related activity. Twice during her initial visit to the playground, Carol glanced at peers jumping on a trampoline; she also displayed simple 'jiggling' motions on the mini-tramp, but no real up / down movements. This was consistent with Monique's initial report in which she stated she did not expect to see Carol perform any jumping related activity because Carol's early intervention developmental worker said Carol would not start jumping for a long time. During the next session, Carol was taught jumping using the GP format. One day later, Carol's motor behaviours were noticeably different. For example,

> *while Carol was in a tunnel on the second level, she stood near a clear plastic bubble type 'window' and clearly moved her upper body up and down six times. As well, after playing on the foam mattresses near a slide*

exit, Carol stood up, said,"Jump, jump, hop..." 12 times, and with distinct up / down movements, walked across the food court area. She made this jerky walking motion 35 times and bent her knees in distinct ways two times in a row during this series. Her mother was very excited when she saw this self-initiated activity, and commented that this was entirely new behaviour - never seen before. She said, "That amazed me. She's starting to get more confident. Wait till I tell her dad what she did!"

Adams' (1971) Closed-loop theory could not explain Carol's novel, rapid, jerky, multi-limb movements (Abernathy & Sparrow, 1992; Magill, 1993; Rosenbaum, 1991; Shea et al., 1993). Schmidt's (1991) Schema theory would have the same difficulty, for his theory explains how general motor programs evolve over time and with experience. If Carol had performed thousands of jumps, and then needed to jump a particular height or distance, Schmidt's theory would have more credibility. Unfortunately, his theory does not address how general motor programs are developed, or, how a child's initial jumping attempts would be produced (Magill).

Elliott's (1990) findings could not explain Carol's rudimentary jumping behaviour and concurrent speech. His neuro-psychological model of cerebral organization predicts that the biological dissociation between speech, vision, and movement control in certain hemispheres, found in people with DS, results in difficulties with tasks requiring speech and the production of complex movements concurrently. Elliott et al. (1990) reports that speech production interrupts motor skills produced on the right side of the body -- specifically the right hand. Carol's jumping action involved right and left sides of the body, and she produced self-initiated speech simultaneously!

Carol's self-initiated jumping action may have been acquired via mental practice. Schmidt (1975, 1991), Cratty (1973a), Rosenbaum (1991), and Magill (1993) state following active involvement, mental practice may: (1) illustrate one's ability and extend learning processes facilitating movement exploration, (2) be beneficial when reviewing efforts on previous motor trials, (3) help detect possible errors in intended movements, (4) assist performance of a well learned skill, and (5) aid memory storage of a successful movement. These purposes for mental practice assume learners have already produced the movement, and therefore, would be unable to explain Carol's jumping related behaviours.

However, Magill (1993) also explains that mental practice, and rehearsal in particular, is an effective response preparation strategy. Since Carol's jumping behaviour occurred after participating in the GP intervention, information presented then may have facilitated the cognitive processes of rehearsal and response preparation. Did the GP teaching tools act as "intermediate links" or "second order stimuli" for Carol? If so, the cognitive processes may have served to transfer "the psychological operation to higher and qualitatively new forms and permit [Carol], by the aid of external stimuli, *to control her behaviour from the outside*" (Vygotsky, 1978; p. 40.). Something influenced Carol to exhibit new and spontaneous jumping behaviours. Information presented using the GP teaching tools, may have provided a way to organize her thoughts which influenced her psychomotor behaviours.

Throughout Carol's participation in the study, her new and growing interest in spontaneous jumping related activities was observed.

> *During the final session at the playground, Carol picked up and used the manikin and pillow in a jumping motion, and said, "Bounce, bounce, bounce" numerous times. A few minutes later, while she was standing on the floor beside the trampoline in the intervention room, she made nine distinct up / down motions on the floor, with bent knee movements, while saying, "Bounce, bounce, bounce". Monique also reported that Carol had initiated new activities and behaviors that appeared to be related to jumping while at home. For example, she had observed Carol make little dolls and teddy bear crackers jump, she moved her "upper body in a jumping sort of motion" when music was on, she used the word, "Jump" frequently, she associated the name of the playground with jumping, and even made up / down motions when asked about going there. Monique also reported when certain songs about jumping were on, Carol actually tried to jump up onto her toes.*
>
> *Overall, Monique commented that she had seen Carol moving with more confidence during the research period. She stated,"...definitely Carol has learned something about jumping....Mentally she has the idea - that her body has to go up (for jumping), but it's not going all the way down yet to her legs - to get her feet off the ground."*

So, based on Carol's responses during the study period, it seemed as if cognitive processes were engaged, resulting in altered psychomotor behaviours.

Lisa

An only child, aged 3 years, 5 months, and 20 days, Lisa was very curious and energetic when we first met. During that meeting, Rose, Lisa's mother, described Lisa's basic level of gross motor proficiency -- saying she could walk, run, climb stairs, kick, and throw, but she was unable to catch or jump. Rose said Lisa had been sliding since seven months of age, when Rose started putting her on a slide, holding her up, and helping her glide down. Rose added,

> *since last summer, Lisa will go up and down slides on her own - except for those twisty ones...She'll drag me up and make me go down first, and then she'll come down. An adult has to come down first on those twisty ones.*

When Rose asked Lisa to display baseline sliding and jumping skills, she refused and began to cry, kick, push, and hit Rose. Yet, during free-play, she displayed sliding behaviours and precursors to jumping. She also slid down the large twisty slide on her own.

Overall, Lisa focused well during the GP intervention. Twice she performed motor acts which she later seemed to "recreate" with dolls. This is how it happened.

> *Lisa and I were sitting on the floor in the intervention room, and I had just started to show and explain to Lisa appropriate sliding posture and action using the manikin and paper tube slide. She wanted to push the wooden doll down the tube slide as soon as it was in proper position, and she did this three times. When I asked Lisa to show me her sliding skills, she turned around and moved away, taking the manikin and tube slide with her. She continued to play, recreating sliding motions down the tube slide with the manikin. I asked Lisa to show me sliding on the big slide. She stood up, took the wooden doll with her, and tried to ascend the slide stairs using one hand. Then she backed down the stairs. I lifted her to the top of the slide, but while I was doing this, Lisa positioned her own feet passively on the stairs - as if she was 'climbing' up them. She sat at the top of the slide for a few moments, said, "Eeeee" long and loud, and manipulated the limbs of the manikin, by spreading the legs slightly, and positioning the arms and hands outward. As Lisa held on to the manikin with her hands, I held onto her back, and Lisa slid down the slide. Next, she stood up, adjusted the arms of the wooden doll inwards and then placed both legs together. She walked behind the slide and standing there, 'climbed' the manikin up the steps, by placing the feet of the doll on each step! Then she sat down and did some sliding activities with the manikin and the paper tube slide.*
>
> *About two minutes later, Lisa repeated the same action of climbing the*

doll up the stairs of the slide, but this time she used the laminated paper doll of herself. This happened during the five minute free-play session, immediately after the final prompt of the cognitive form of intervention. Lisa walked over to the table where all the teaching supplies were kept, and she found the laminated paper doll. She positioned the legs of the paper doll together, walked over to the back side of the slide, and climbed the doll up the stairs of the slide. Then she turned the paper doll so it was facing upwards, laid it down on the surface of the big plastic slide, and positioned the doll with it's feet forward but angled slightly to the left. She said, "Me, me, me, me", and then while watching the doll, Lisa nudged it forward and let the paper doll slide down the slide. It was difficult to see the exact arm and leg positions of the doll when she released it, but on the ground, the doll's arms were extended to the sides, and the legs were positioned slightly apart. Then, completely self-initiated, Lisa walked to the right of the slide stairs and laid on the floor on her stomach, for a short period of time. Lisa's arms and legs were spread outwards in a manner that duplicated the same limb positions of those of the laminated paper doll!

It seemed as if Lisa reconstructed or revisited her own motor experience using objects designed to facilitate motor planning. While her actions may have been coincidental, other situations also suggest Lisa was processing psychomotor concepts and skills using various dolls. For example, although Lisa only participated in the GP format for sliding, she exhibited this at the research site with dolls, and Rose reported she displayed this understanding of sliding at home and at their church playground in the week that followed. Lisa also seemed to need to "make sense" of the concepts gained related to sliding, and apply them to jumping as well. Her behaviour during the final free-play session portrayed this.

As soon as Rose brought Lisa into the intervention room, Lisa picked up the laminated paper doll, walked over and placed it upright on the large trampoline, and then lifted it up and down in a jumping motion numerous times. Then she put the paper doll down, and picked up the manikin. She walked over to the trampoline again while manipulating the arms and legs of the wooden doll. She said, "Ba, ba, ba, ba, ba" and made jerking motions with the manikin on the trampoline surface. Rose said that Lisa's "Ba, ba, ba" really meant, "Jump, jump, jump." Lisa lifted the manikin up, and then letting it go, tossed it on the mat of the trampoline. She picked it up again, moved it up and down in a semi-jumping motion three times, and threw it on the mat again as part of the third movement. Lisa raised her own arms and moved them in an up / down motion two times. Then she got onto the trampoline, crawled over and sat beside the manikin. She picked it up and then tossed

it on the ground. Next, she stood up, did some quick high stepping activities, sat on the trampoline, made 5 small bum bounces, and then kicked the surface of the mat with her legs and heels for a few minutes. Eventually she climbed off the trampoline and spent the remainder of her time in the main play area.

Once again, various motor theories would not be able to explain Lisa's self-initiated display of motor behaviours with dolls. Adams' (1971) theory depends on direct feedback or external knowledge of results to alter preexisting knowledge of motor skills. Lisa had not been given any type of feedback while she displayed different motor activities with the dolls, and her play with dolls did not provide her with direct feedback related to personal performance of the motor activity. Swinnen (1996) recognizes that people can acquire motor skills without knowledge of results, and states feedback is not critical to motor learning.

Schmidt (1975, 1991) may be able to defend some of Lisa's behaviours using his Schema theory, commenting she already had a "walking up slide stairs set of rules" and a "sliding" schema, therefore, she knew how to behave when performing those skills with new pieces of equipment. Unfortunately, he would not be able to explain Lisa's interest in displaying "new" jumping related activities or her "motor skill play" with the dolls.

Those supporting a dynamic systems theory may suggest that Lisa's immediate response of lying on the ground, in a manner representing the laminated doll's position after sliding, was triggered directly by the environmental cue of viewing the doll lying in that position. However, the dynamic systems theory would not be able to explain why Lisa used various dolls to walk up the slide stairs, then slide down, or, display jumping related activities, because this theoretical perspective does not support any representation of desired movements or other memory processes while learning motor skills (Abernathy & Sparrow, 1992). Rather, this theory proposes Lisa's response to the slide stairs, slide, and trampoline would be to perform the various gross motor activities on these pieces of equipment using natural action herself. Some other explanation is needed to explain how and why the dolls activated or stimulated a connection to motor actions, since she purposefully used them to display some

understanding about walking up stairs, sliding, and jumping.

Vygotsky (1978) refers to a child's ability to utilize primary and auxiliary stimuli in ways that establish specific relationships between them. He writes that through the use of "second order stimulus (signs)" (p. 39) a child actively establishes linkages between a stimulus and response. When this occurs, the child is "showing that s he knows that certain signs will help to achieve certain operations. Once this happens, the child no longer experiences difficulties in creating relations and using them" (p. 72). It appeared that Lisa was able to use linkages previously made for her related to sliding, apply them to jumping, and, in this way create new relationships on her own! Vygotsky calls this "the stage of external sign use. It is characterized by the independent formation of new relations in the child's internal operations using externally presented signs" (p. 72). Vygotsky comments that this is a fundamental stage which is followed by the child's ability to begin to "organize stimuli of an internal nature" (p. 72). It seemed as if Lisa used external objects to display her memory or understanding of certain relationships, operations, and motor concepts presented previously. Vygotsky reports that these external displays give an indication of what internal gains and what types of connections have been made.

This may also explain why Lisa used the dolls to display her understanding of jumping on the final day. If, as it seems, the scaffolding of information using the GP teaching tools helped Lisa to construct a cognitive representation of sliding, then she may have also needed to apply this same strategy to help make sense of jumping behaviours. And, if, as Vygotsky (1978) suggests, a child can form new internal operations through the use of external signs, then it stands to reason that new applications of the internal formation may also be constructed. So, if Lisa constructed an intrapsychological cognitive representation for sliding, she may have also wanted to "play back" a new intrapsychological cognitive representation she had developed for jumping.

It appeared as if the play with dolls provided new ways for Lisa to express her knowledge of various concepts. Rose noted this too. When asked if she had any evidence supporting the efficacy of one teaching style over the other, Rose gave an interesting answer, which revealed Lisa's use of dolls in other settings and for other purposes.

Well, yesterday I was reading a book with animals in it, asking Lisa to show me the mommy pig and the baby pig, and she had a baby doll on her lap, and she got her doll to point to it. Like she wouldn't do it herself, but the doll would do the right answer. Then I asked her to give me five, and she got the doll to give me five, and then she got the doll to give herself five. (P: Have you ever seen that before?) I've seen her get a baby doll to point at things, but the give me five was new, and the fact that she gave me the right answer, that was new!

Based on Lisa's gross motor activity and related behaviours during the research period, it appeared as if she benefitted most from the paper doll and manikin. She appeared to use these dolls to recreate or revisit various events and skills. Therefore, it seems Lisa did make gains in understanding and performance of psychomotor behaviours during the short research period. The fact that she used other dolls at home and at church, for different purposes, also seems to indicate she was able to display inner knowledge of psychomotor concepts using external means.

Ali

Ali was 3 years, 10 months, and 9 days of age when she entered the study. Ali has a younger brother; the two children are involved in various activities and programs. Ali's mother, Pat, described Ali's gross motor abilities during the initial interview, saying she was fairly active, had been involved in a gymnastics program for some time, and the program helped tremendously. Pat added that Ali could jump and slide independently, she was good at both skills, and a bit of a dare devil when sliding, but she especially liked to jump. Pat also said Ali performed both skills as games, saying, "Everything is a game when she jumps" and, "You have to count before she goes down the slide." Pat mentioned she thought Ali's gross motor development had to do with getting stronger, having muscle strength to do various skills. Pat also said Ali liked to run, chase her brother, kick the ball, and throw. She added that Ali was trying to learn to catch right now. However, Ali's jumping and sliding skills observed during pre-assessment did not correspond with Pat's description. She did not display independent sliding, and her jumping skills were not fully mature in form.

Like Carol, Ali used words to describe jumping when acting out this motor

skill with the manikin, but, she also used words and actions when representing jumping in a more abstract manner. For example,

> *During the second GP intervention, four cartoon cards were shown and explained to Ali. She immediately picked up card #4, and moved it rapidly up and down four times, saying, "Jump, jump, jump, jump." Then she took card #3 and made the same up / down motion with this card 11 times, again saying, "Jump, jump, jump." Later, during the post-intervention jumping tasks, Ali was asked to reconstruct a series of four different cartoon cards that displayed a character standing beside a trampoline, climbing onto it, preparing to jump, and then actually showing the upward motion of jumping. Ali began by picking up the card that resembled a person crouching in the preparatory position for jumping (card #3).She pointed at the cartoon figure on the card, and then said, "Jump, Ali, Ali". After the instructions were repeated again for clarification, she pointed to card #3 again, and moved it up and down as if making a jumping motion herself. Then she raised her arms and hands in a shrug type manner and said, "Done."*

Although Ali did not place the cards in proper sequence as part of the task requirement, she recognized that the cartoon cards depicted jumping action. Gillham (1983) reports children with Ds are able to define visual representations of objects in cartoon pictures, and Golomb (1992) writes typical children aged five to seven years of age are able to make "competent discriminations and reveal their reliance on certain representational principles" (p. 317) using cartoon-type pictures. Oelwein (1995) writes that children with Ds generally use visual language before using verbal language, and offers hundreds of cartoon-type pictures as teaching resources in her book. Klager (1996) and Lund (1994) add that for children who experience difficulties with speech and oral language skills, pictures may actually evoke language references, and therefore, pictures should be used as teaching tools.

Vygotsky (1978) also comments about the usefulness of pictures while teaching concepts to children. He reports young children typically describe objects in pictures, whereas slightly older children describe actions in pictures and may indicate complex relationships of various objects in a picture. Ali definitely communicated her knowledge of the contents of each picture, using pantomime and verbal expressions. This supports Vygotsky's claim that children use pantomime to show actions in a picture because of limited

language development. He writes that children generally use "very expressive gestures [as a way to] compensate for their difficulties in communicating meaningfully through language" (p. 32).

The use of gestures to compensate for delayed expressive vocal ability has been confirmed by others. In a study comparing relationships between speech production and gesture use in typically developing and late-talking toddlers, Thal and Tobias (1994) report late talkers produced significantly more gestures than age-matched subjects or language-matched subjects. This has also been substantiated by Casell, Vicari, Longobardi, Lami, Pizzoli, and Stella (1998). They found children with Ds aged 10 to 49 months, had verbal comprehension, but used gestures to offset delayed speech production. Upon closer examination, they report, "Children with Ds produce a greater percentage of gestures in categories that imply more advanced cognitive skills, including symbolic communicative gestures, and actions which involve an ability to perform symbolic transformations" (p. 1132). This adds further evidence to findings in Ali's case.

In a study with adults learning a second language, McCafferty (1998) discovered gestures serve in a self-regulating capacity, seem linked with inner speech, and are often combined with thought in presentations of meaning. In essence, mediational activity becomes embodied. He cites McNeill (1992) and Vygotsky (1986) who claim gestures often reveal a person's underlying mental activity. This is different than Piaget's view on gestures and intelligence.

Piaget (1962) believes gestures are simply forms of motor activity. Upon occasion, rituals arise out of chance unrelated gestures, becoming a sensory motor game. As intellectual concepts are developed, sensory motor schemas transform into systems of verbal signs, and the sensory motor schemas are dropped in favour of the "higher" level of verbal sign usage. Unfortunately, Piaget's theory is unable to explain Ali's behaviours, since she used verbal expressions along with gestures. Therefore, it follows that Ali used gestures to reveal her cognitive understanding of psychomotor concepts, as a way to avoid challenges with speech production, or for both purposes.

Other findings in Ali's case showed her resourcefulness in communicating knowledge of certain aspects of jumping, which she may not have been able to describe verbally. This happened in the following way.

During the post-intervention tasks for jumping, four picture cards of real children doing various physical activities were placed on the table. The question, "Who is jumping?" was asked. Ali gave the right answer immediately. When asked how she knew it was correct, she picked up the other cards, said, "Walk, slide, sit" to describe the action in the other pictures. I asked her again, and Ali gave the same correct response. When asked how she knew this was the right picture, she stood up on her chair, made little up / down movements, and then turned in such a way that I could see her left leg clearly. Then she duplicated the bent knee position and leg angle of the girl in the picture card who was jumping, with her own left leg!

Gardner (1993) writes that people are generally asked to express their knowledge of various concepts using a linguistic-logical form of intelligence, even though there are actually seven forms. He comments since "every cognitive act involves an agent who carries out an action or a set of actions in some task or domain" (p. 50), we must facilitate connections between practical knowledge and those forms of intelligence embodied in other forms and domains. We need to consider individuals as a collection of various abilities and skills, and allow them to solve problems in new ways. Then, when they arrive with a product or solution, we must give them opportunities to comfortably display their knowledge and learning and communicate this through a new more comprehensive domain. We must learn to permit this freedom because a "young child creates without respect to the domain and the field" (p. 59-60). Gardner reports when he allowed children to use various forms of intelligence, "a number of children showed reflectiveness and attention to detail in their area of strength" (p. 97). It was as if Ali was using a bodily-kinesthetic form of intelligence to show her response to the questions posed during the post-intervention task; she simply communicated her knowledge of proper leg positions for jumping through her body action. This indicates her ability to use the bodily-kinesthetic form of intelligence. Others (Cratty, 1973a; Eisner, 1982; Holt, 1995) also comment that children need freedom to use other forms of expression to display their knowledge of various events or concepts.

Although Pat said Ali had the ability, Ali seemed unwilling to display independent sliding and jumping skills at the onset of this research. Therefore, it is difficult to determine exactly what changes occurred in her psychomotor ability over the research period. However, Ali's mother noticed a change at

home during the eleven days. During the final interview, Pat was asked if she observed any activities or behaviors that appeared to be related to sliding and or jumping during the research period. Pat answered that Ali started

> *jumping off of the sofa, from the cushions to the ground - and that's quite a distance I thought! (P: That was a new skill?) Yes. And she climbed over the back of the couch - like climbed up and over like a mountain. So she did some of that stuff. That's what I saw that was related to the activities here. (P: And that was all self-initiated?) Yup.*

Pat also observed Ali trying to process and express information about jumping in ways other than speech, or performing the gross motor activity personally. She said Ali would "kind of make the actions and kind of do it, like...bend her knees if she wanted to jump. She'll let you know ahead of time."

The incidences documented through Ali's case, showed her creativity in finding solutions to tasks and giving answers while using a bodily-kinesthetic intelligence and personal motor responses related to the psychomotor domain.

Sue

Sue is a very tiny girl with a seemingly happy disposition. Aged 3 years, 11 months, and 5 days, she is the youngest of four children in a family. Her oldest brother already lives on his own and her other older brothers attend grade school. Grace, Sue's mother, spoke about Sue's gross motor skills, saying she liked to slide, go to the park, and swing there. Grace said Sue's only jumping related activity was to sit on, and do a "sort of jump / bum bounce on a ball".

When Grace was asked about the strategies she used when teaching gross motor skills to Sue, she said,

> *I didn't think you had to teach them that....I never thought they were taught things like that - I thought they just did things - like, just pick them up 'cuz they are kid things.*

She stated since she liked physical activity herself, she thought Sue might enjoy similar activities and just acquire gross motor skills somehow. Grace added because Sue had big brothers, she could simply watch and copy their actions.

As part of the pre-assessment, Sue was asked to display her baseline skills, and did so willingly. While her mother stood and watched,

Sue tried jumping first. She climbed onto the mini tramp, held onto the support bar, and made some distinct up / down motions, however, she did not lift her feet off the mat. For her sliding trial, she climbed up the slide stairs, sat on the top platform, placed her hands on the slide edges, spread her legs slightly, laid down, and slid down. She landed quite hard, and appeared to have hurt her bottom. Then she played freely in the main area.

The next day, Sue was brought to the intervention room. Her scheduled intervention began with the C&P teaching style for sliding. I gave Sue the first set of instructions for sliding, and she began immediately. She climbed the slide stairs, extended her legs forward, sat down on the top platform, spread her legs slightly, and placed her hands on the edge of the slide. Then she leaned back into a lying position, and slid down. Her descent was quick and she seemed to have hurt her bottom. Then she stood up, and headed directly to the large trampoline. I redirected her and gave her the second set of instructions. She repeated the same sliding response. On the third trial, Sue became resistant and would not descend.

I gave her a short break, and then the request for sliding was resumed. Sue slid down once more and seemed to have hurt her bottom again. I was unable to watch this happen again, so, even though she was to respond to the C&P format herself, I purposely slowed her down during this descent so that she would not hurt her bottom again. During the fifth trial for sliding, Sue slid down when asked, but I slowed her down again so she would not hurt herself. In all cases, Sue had been laying down on the slide for each descent. However, during the last trial, I held onto her chest and back, and supported her in such a way that she was in a sitting position while sliding.

A week later, Grace's journal was collected. She had written,"We observed Sue sitting up on the slide instead of leaning back on her back".

Sue had participated in sliding skills using a C&P teaching approach. Specific instructions were given about arm and leg positions, but sitting was not mentioned, since it was assumed children would automatically sit while sliding. It appeared this was an aspect of sliding Grace had not worried about either. Grace mentioned earlier she thought children picked up motor skills on their own. How did Sue acquire sitting while sliding? Improvements may have been a maturational or developmental gain (Kim et al., 1996; Wickstrom, 1983), the result of practice (Corcos, Jaric, & Gottlieb, 1996; Schmidt, 1975, 1991), self organization of many components establishing equilibrium (Bernstein, 1967; Kugler et al., 1982; Kugler & Turvey, 1987; Schmidt & Fitzpatrick, 1996; Wallace, 1996), or, independently calculated by "just knowing".

For example, Sue's new ability to sit while sliding may be explained by

Gentile's (1972) motor learning theory. She reports the first aspect of motor learning is to "get the idea of the movement". This is done by establishing what is relevant / non-relevant stimuli, determining the most appropriate movement pattern, and then coordinating the limbs appropriately. In this case, Sue may have "gotten the idea of the movement" after experiencing a proper sliding position. So, rather than learning to coordinate limbs properly, she may simply have learned how to position her trunk using upright posture!

Adams (1971) may explain that by positioning Sue in an upright position for sliding, she acquired just enough internal feedback from the simple unidimensional movement to create a correct perceptual trace for future use. However, this implies all previous sliding trials were stored within the closed loop system as "perceived errors". Would one new feedback message have the ability to override and correct the perceptual trace of all former sliding movements? Probably not. Adams and Rosenbaum (1991) recognize this is a problem with his theory. Schmidt's (1991) schema theory would also experience similar difficulties if they attempted to report that one new feedback source altered Sue's "sliding set of rules" into a mature form of sliding. His theory states after hundreds and thousands of sliding trials, a sliding schema becomes strong. However, Schmidt is unable to justify how one new sliding response results in consistently more mature sliding posture.

Dynamic systems theorists would have difficulty justifying Sue's new sliding behaviours as well, since no environmental conditions changed -- except for my assistance of Sue's posture. However, they may comment that Sue already had some coordination patterns among the components of sliding, and her back muscles and joints were finally coordinated in a proper manner to sustain sitting while sliding (Kelso, 1982; Kugler et al., 1982; Kugler & Turvey, 1987; Schmidt & Fitzpatrick, 1996; Wallace, 1996). Even with their extremely complicated explanations, they would not be able to rationalize why she sat independently in other locations before this time, but not while sliding down a slide.

Those working in the area of neuro-physiology or neuro-psychology may claim that one aspect of the neuro anatomy was influenced by the assisted sitting while sliding behaviour, and this may have resulted in higher level functioning. Those explaining motor learning, using a sensory integrative or

perceptual motor approach, may claim that some aspect of the movement affected the brain stem or central nervous system, and that this also resulted in positive gains in sliding behaviours.

Typical motor learning theories would have difficulty explaining Sue's improved behaviours, however, if gains were in the cognitive domain, Vygotsky (1978) would propose alternative explanations. One explanation refers to the ZPD, and another proposes that interpersonal acts become intrapersonal acts.

By positioning Sue in a sitting position during the final C&P sliding trial, she may have made a "leap" to independent sitting while sliding. The assistance offered was very quick, and no other instruction was given; however, Sue may have recognized this assistance as the increment needed to acquire sitting while sliding. Initially, Grace said she did not teach motor skills to Sue; she hoped she would pick them up by watching others. As a result of Grace's perception, Sue probably received very little, if any, support or guidance from her mother. If Sue needed this simple act of assistance to develop more appropriate sliding skills, then we were working in, what Vygotsky (1978) calls her ZPD. Crain (1992) comments about this aspect of Vygotsky's theory, and how instruction relates to it. He writes Vygotsky believed instruction "should march ahead of development, pulling it along, helping children master material that they cannot immediately grasp on their own" (p. 211). Crain adds, Vygotsky believed instruction "interacts with development, awakening it, charting new paths for it" (p. 213), and this results in propelling the mind forward. If Sue was at the "tip" of independent sitting while sliding, then this single and natural application of motor instruction may have been all she needed to chart a new psychomotor path.

On the other hand, Vygotsky (1978) may propose another explanation for Sue's quick gain in sitting while sliding. He writes

> every function in the child's cultural development appears twice: first on the social level, and later, on the individual level: first *between* people *(inter-psychological)*, and then *inside* the child *(intrapsychological)*. This applies equally to voluntary attention, to logical memory, and to the formation of concepts. All the higher functions originate as actual relations between human individuals (p. 57).

It seems this explanation may also apply to the psychomotor domain. Sue's

improved sliding behaviour may be the result of an interpersonal motor activity, transferred into personal understanding, evidenced by her own motor activity -- an intrapersonal action! This even corresponds with comments made by Schmidt (1991), who reports once an individual develops the ability to perform a motor task, he / she performs it voluntarily, completely independent of any external force, because decisions about voluntary movement now come from within. Only reflex activity, which Vygotsky (1978) would refer to as part of the biological line, has the ability to override intrapersonal motor action.

According to Grace, Sue's jumping skills had changed noticeably during the eleven days. During the final interview together, Grace reported,

> *She says, "Bounce, bounce" a lot. She'll jump on things....It's more accelerated behavior. Like she would do it before - but it was never intentional before. She would just do it. Now it is something that she does because she wants to. Because it is more in her mind.*

In addition, Grace was asked if she thought Sue could process and express information about sliding or jumping in ways other than speech and / or performing the specific gross motor activity. Grace reported she had seen a change in Sue's ability to express information during the last week.

> *Ya, I saw it with a paper. We went to this meeting yesterday morning, and she's saying with her crayon, "Bounce, bounce, bounce" and they are all dots on the paper. I thought that was funny. She's coloring it! ...:Before, it was like the crayon was doing the activity - and now this time it's like she is doing it - like making the crayon do the activity. Funny heh?*

It seemed Sue used gestures to represent her understanding of jumping action. Vygotsky (1978) refers to this exact situation in a discussion on gesture and visual signs. He comments that gestures and movements are a symbolic representational activity which illustrate what a child is trying to communicate. He writes, "The gesture is the initial visual sign that contains the child's future writing...and written signs frequently are simply gestures that have been fixed" (p. 107). "The child's self-motion, his own gestures, are what assign the function of sign to the object and give it meaning" (p. 108). Then he comments about how this process occurs. Children use a gesture language or gestural representations to display their knowledge of events or concepts. Vygotsky writes,

A child who has to depict running begins by depicting the motion with her

> fingers, and she regards the resultant marks and dots on the paper as a representation of running. When she goes on to depict jumping, her hand begins to make movements depicting jumps. (p. 107)

Sue's self-initiated artwork representing jumping, was never observed by Grace before the research period, and Sue was not taught to draw jumping. This was her own construction of the motor skill, evidenced through gesture and written signs!

The examples of changed psychomotor behaviours seem rather subtle in Sue's case. Based on her free-play activities before and after intervention, there were no extreme advances in motor performances. Without knowing exactly how she was processing information about sliding and jumping, it is impossible to determine exactly how changes occurred. Nevertheless, according to Grace, it appeared as if something made a difference in Sue's gross motor learning and development. In the final interview Grace said it seemed as if Sue's gross motor activity was more planned lately.

> *Now it is more intentional,...like saying and doing the actions and words at the same time. It's more,...like, accelerated. Like, it's different; she doesn't worry about things any more. Like she used to worry about stepping down, she'd worry about bouncing,...only because she wasn't sure how she would end up. And in the end she wanted to know that. Well now, she doesn't worry about it. She just does it. It's like it's come naturally!*

Grace felt Sue really benefited from this short exposure to teaching gross motor skills a different way. She referred to it as a "waking point" for Sue.

Grace recognized there may be a benefit in using one teaching style over another. When asked if she thought the C&P or the cognitive form of intervention was more effective than the other, Grace replied,

> *Yes, I would say that the second would be better, but I don't know how to do that. I don't know how to get a child to think and then do it...rather than telling them, "Do this, do this." It is better though, because in one, the child is thinking, rather than the other, where in the other, the child isn't thinking, they are just doing.*

Grace also commented that Sue was

> *becoming more independent. She climbed up into her high chair for lunch today, without help....It seems to be the norm now to go up on her tiptoes to see things. Like loonies on a counter, or other things that are just out of*

reach, just in the last week.

So, although the research period was very short, and Sue only had one opportunity to try each GP, Grace felt a difference was made in Sue's gross motor learning and development. Had the research period been longer, and more intervention sessions provided, differences may have been more noticeable. Still, it appears Sue's understanding and performance of sliding and jumping related activities were influenced in positive ways.

John

John is the only child of a couple who works in the same industry. The husband and wife try to arrange their work schedules so they do not have overlapping shifts. As a result, one parent is generally home at all times with John -- to provide stimulation, take him on many outings and to different places, and enroll him in various programs and summer camps. For example, approximately once a week, for three years, John's parents took him to the playground where the research was conducted. Therefore, at 3 years, 11 months, and 6 days, John's age when entering the study, he had already visited the play area about 150 times, and was very familiar with the surroundings there.

During the initial visit to John's home, research activities were explained. However, with the exception of the laminated paper doll, which needed to be shown to explain why photographs of John were needed, other teaching tools were not displayed or described. At that meeting, John's mother, Bev, described John's physical abilities and told how she and her husband were proactive about developing John's gross motor skills. Bev said John had been sliding since age one and a half years, and he seemed to have no fear. Jumping was a recent accomplishment -- within the last six months. John loved jumping; he and his parents made it into a game, doing it in many locations and in many situations.

Now he is jumping all the time. On the furniture, on the couch, on the floor, being a monkey, a kangaroo, on demand, on request, on his own, with dancing and singing...

When asked if she thought John could process / express information about

sliding and jumping in ways other than speech and / or performing the specific gross motor activity, she said, although she had not seen it, she thought he may be able to show certain activities with dolls -- making them perform similar skills.

During the pre-assessment session at the playground, when Bev asked John to perform baseline sliding and jumping skills, he did not comply. She initiated a game to perk his interest, and eventually he displayed his jumping ability; he flexed the knees properly, lifted his feet off the mat correctly, but arms were held downward, extended out and back. When John was asked to slide, he refused, and Bev could not convince him otherwise. Later, while interviewing Bev, a research assistant reported John slid down. However, the descent was not video-taped; it was impossible to determine if he used proper sliding form.

John's case highlighted two interesting incidents -- one relates to activity stimulated by a pictorial representation of a visual field, and one relates to self-initiated play of jumping related activity. The first activity described occurred at the playground research site and the second incident happened at home.

> *John had been involved in the research project as scheduled, and it was near the end of his final free-play session at the playground, when he walked into the intervention room, looked at the poster of the slide momentarily, threw it down, and then grabbed the jumping poster. He looked at it for a moment, put it down, walked over to the trampoline, and climbed on. Once there, he did seven jumps, got off, walked to the mini tramp, made two simple up / down motions there, crawled back onto the big trampoline, and did seven more jumps, ten crazy-twisty-turning jumps, and three bum bounces. Then his one hour free-play session was complete.*

Had John planned to jump before he entered the intervention room, or did the poster of the jumping room "trigger" his memory of that activity? If he simply saw trampolines in the intervention room, walked over, and started to jump on them, then, this may have been an elementary or natural form of memory evoked by the perception or direct influence of an object or event on a person. "The central characteristic of elementary (memory) functions is that they are totally and directly determined by stimulation from the environment" (Vygotsky, 1978, p. 39). This seems similar to the dynamic systems perspective which proposes objects in the environment spontaneously evoke physical activity.

However, John's reaction to the trampoline was not that spontaneous. First

he looked at two posters; that seemed to spark his interest or recollection of jumping. Did John's idea to initiate jumping come through a memory or perceptual trace of that activity (Adams, 1971)? Although his theory suggests actual jumping movements leave perceptual traces, he could not explain how a poster would trigger a memory about jumping. In addition, Adams believes one's desire to jump is attributed primarily for the detection of errors, constantly needing to alter and correct current jumping motions (Rosenbaum, 1991). If the poster of the jumping room served as a simple memory aid, causing his interest in jumping, another explanation is needed.

The poster of the jumping room may have triggered the desire for jumping by altering:

> the psychological structure of the memory process. [Memory aids] extend the operation of memory beyond the biological dimensions of the human nervous system and permit it to incorporate artificial, or self-generated stimuli, which we call *signs*. (Vygotsky, 1978, p. 39)

This suggests that self-generated stimuli, activated by the poster, caused John to initiate jumping action. Even though the poster of the jumping room did not feature similar jumping equipment used in the intervention room, the images may have reminded him of the mediated impressions about jumping on the two "intervention" trampolines. This recollection may have prompted self-generated activity. "For higher [memory] functions, the central feature is self-generated stimulation, that is, the creation and use of artificial stimuli which become the immediate causes of behaviour" (Vygotsky, p. 39). This explanation seems to describe how John's jumping behaviour followed his viewing of the "jumping room" poster.

After the final session, Bev answered a few questions. When asked if she observed any activities or behaviors seemingly related to sliding and jumping during the research period, she said that she observed and heard many activities that seemed related. She stated,

> *John is now jumping off a little slide (that goes into his wading pool) - - straight into the water and doing, "Splash, splash, splash." When I told him we were going to (the large indoor playground), then he started to jump. I said, "We are going to see Paulene", and he started to jump. He has never done that before, so he probably associated you with that. You might be here and he was coming here to jump on that thing (She points to the*

trampoline). So that is pretty much it. One other thing may be new or different. David (John's father) is gone right now, and John usually does his jumping thing with him, but he is doing it on his own now...He comes and gets me by the hands now and then brings me over to the stairs, and wants me to watch him jump.

In addition, Bev was asked if she thought John could process and express information about sliding or jumping in ways other than speech and / or performing the specific gross motor activity. She said,

He's got four little teletubbies that are about two inches tall, and he is playing with them two at a time in each hand. So he is having them jump around the house, and in his car seat as we drive around, on top of the TV... (P: And he's done that for a long time?) No, that is fairly new - this last week. He is interacting with his little figurines more...Usually we have to show him how to play with little figurines and dolls, but now he is doing it on his own. He seems to be having them interact with each other. And he has been throwing them on top of the couch - right where the top of the couch is touching the wall. So, from the bottom of the couch he is throwing them up. He hopes they will stay on top. If they bounce back off again, he throws them up again, and he does this until all four are on top, and then he climbs on the couch and gets them off. It is new game. I don't know if that is related to this... who knows? But, he is wrecking my wallpaper!

Bev was clear that John's play was a purposeful and controlled representation of jumping, for play associated with throwing would have resulted in wild and uncontrolled tossing of multiple objects in many directions. Bev also reported she had not observed John self-initiate play with small figures before.

John's new jumping behaviour off the slide may be explained by the neurodevelopmental or perceptual motor theorists if Bev purposefully impacted John's brain or brain stem with sensory integrative techniques during the days he was at home with her. It would be considered a remarkable gain! Even so, jumping, evidenced in the play with figures would be unexplainable.

Numerous theories about play behaviours exist; Johnson et al., (1987) reviews and critiques them. Classical theories attempt to explain why play exists and the purpose it serves, while modern theories "try to determine play's role in child development and, in some cases, to specify antecedent conditions that cause play behaviour" (p. 6-7). Of the six modern theories presented, only Piaget and Vygotsky's ideas will be presented.

Piaget's (1962) theory suggests John's play was produced for functional pleasure and satisfaction; it was a way for him to master the jumping schema and keep it from becoming atrophied. Piaget believes children's play is a private process which serves to incorporate and consolidate acquired knowledge and events into existing mental structures. Piaget would add that John simply re-lived and practiced jumping skills in his play behaviours. This corresponds with Mosston and Ashworth's (1994) comment, that after discovery learning, children must repeat movements to verify solutions and reach developmental purposes of tasks.

However, Mosston and Ashworth (1994) also state solutions to motor tasks belong to each learner. Children need time to develop, examine, sift through, and eventually decide on appropriate solutions to problems. When cognitive solutions are generated, but physical limitations do not allow for production of movement, responses may be expressed in different and unique forms, intrinsic to the subject matter. This may be accomplished through a "reduction process", where something else (i. e. models, dolls, peers) performs skills a child cannot. The reduction process involves a reduction from a possible cognitive solution to a performance solution that is acceptable in the learner's eyes. Use of the reduction process results in the acquisition of skills and abilities "beyond the present limits of knowledge" (p. 205) during which time the child displays independent physical and cognitive responses, and actually demonstrates a cognitive / physical relationship in action. However, because this occurs in what Mosston and Ashworth call "unknown territory" (p. 204), it follows that skills exhibited in play have not yet been learned or developed. Therefore, Piaget's theory may not apply. On the other hand, Vygotsky's (1978) theory, which suggests that play is a learning activity, may pertain to John's self-initiated behaviours.

Bev reported John had been jumping for about six months, and his typical behaviour was to jump down the last step of the stairs. His play, making upward jumping motions with four teletubbies, was different than his own motor ability. Teletubbies are television characters, typically associated with singing and dancing; they are not normally rambunctious, energetic, and fast moving. However, John created this type of play with them. He may have had the idea to

act out his understanding of jumping; he simply used teletubbies to display the motions. In so doing, he separated the normal play actions associated with the teletubbies from these objects. The ability to separate the object from the ideas used in play, corresponds with Vygotsky's (1978) philosophy about play. He believes play is determined by ideas rather than objects, and because of this, children's play is a leading factor in cognitive development. He states,

> Play creates a zone of proximal development of the child. In play, a child always behaves beyond his average age, above his daily behavior; in play it is as though he were a head taller than himself....play contains all developmental tendencies in a condensed form and is itself a major form of development. Though the play-development relationship can be compared to the instruction-development relationship, play provides a much wider background for changes in needs and consciousness. Action in the imaginative sphere, in an imaginary situation, the creation of voluntary intentions, and the formation of real-life plans and volitional motives - all appear in play and make it the highest level of preschool development. The child moves forward essentially through play activity. Only in this sense can play be considered a leading activity that determines the child's development. (p. 102-3)

Was John's play with the teletubbies an attempt to act out the next stage of jumping -- to jump down from increasingly greater heights and in an upward motion (Folio & Fewell, 1983; Wessel, 1980b)? Was this a way for unrealizable tendencies to be realized (Vygotsky, 1978)? By throwing the characters onto the top of the couch, then tossing them all down again, and repeating this over and over, was John rehearsing upward jumping action, and jumping down from greater heights, two skills he cannot yet perform personally? Because his current jumping related behaviours may have been limited by biological factors such as low muscle tone and muscular strength, was he playing out future desires this way?

Since there was no way of knowing exactly what ideas John had while playing, it is impossible to know what his motives were. Nevertheless, Vygotsky's (1978) theory seems justifiable in this case. According to his theory, play provides opportunities for children to learn to act in cognitive ways and express their understanding of the concepts and events which were provided through socio-cultural interactions and materials (Nicolopolou, 1993). John

appeared to use strategies and objects similar to those used in the GP format, to express his understanding of jumping behaviours in self-initiated play. Therefore, the short GP intervention session seemed to have influenced his comprehension of jumping behaviours.

While John's case did not clearly reveal which teaching style was most beneficial, his self-initiated look at the posters in the intervention room and Bev's comments about John's interest in jumping off his pool slide and making the teletubbies "jump", may indicate that John was reflecting on, rehearsing, revisiting, or reconstructing jumping skills during the research period. If that was John's intent, one could infer that cognitive processes about jumping related behaviours had been activated during the research project. Bev's account of John's advanced jumping skills, supported observations made at the research site, and seem to indicate that modifiability of the psychomotor domain occurred.

Rob

Rob is the third child of four children in a very busy family. He has two sisters, one eight and one six years old, and a younger brother who is about 20 months of age. Rob was 4 years, 8 months, and 10 days old when he entered the research. None of the children had ever been to the indoor playground.

When I first met Ruth, Rob's mother, and her children, all research activities were shown and explained. Then she answered questions about Rob's basic level of gross motor ability. She said Rob slid sitting forward on his bum and he spent time on a little slide they had at home. She added that he

> *was not shy of going down a larger slide. I've never tried him on one that was too high. He has a tendency to be a little scared of heights, but the slide itself he enjoys. (P: Tell me about his jumping ability.) Well, Rob jumps a little bit - he's very stiff legged with his jumping movements, but he will jump....He doesn't jump very high.*

Ruth was also asked if she thought Rob could process and express information about sliding and jumping in ways other than speech and / or performing the specific gross motor activity. She said,

> *I'm not really sure - I've haven't really thought about it or tried anything with Rob. I think maybe with a doll or something - he might be able to role model*

it. (P: Have you ever seen him do that?). No. He plays with dolls, sometimes feeding them or pretending to do other activities, but I've not seen him have them move around or jump particularly.

During the pre-assessment session, Ruth asked Rob to jump and slide for an indication of his baseline skills. At first Rob refused. Ruth humored him and then placed his hands on the support bar of the mini tramp to get him started.

He whimpered and sat down. Ruth asked him to stand, held onto Rob's hands, and got him to initiate some simple up / down motions. Then she helped him turn and place his hands on the support bar again, and said, "Now you can hold onto here and do it this way." Rob performed two jumps and fell down landing on his bum. He got off. Next, Rob climbed the slide stairs on his own volition, and when he got to the top, twisted his legs around so he was laying on his stomach. Ruth said, "Get your legs down." Rob did, and then slid backwards on his stomach - feet first. Additional coaxing by his mother was required and effective. Rob slid down while sitting on his bum; his hands were extended forward, so he could hold onto his mother's hands for support and guidance, which he did.

Rob showed some jumping and sliding related behaviours during the initial free-play session. The next day, he began the intervention session by participating in the C&P format for jumping. This was followed by post-intervention tasks for jumping - one task was to show jumping related activity using a manikin and pillow. Maybe the instructions were unclear to him, but at first, Rob did not seem to grasp what he had to do with the manikin and pillow, for he did not use the models this way. He did however, make slight up / down motions on the table and an alternating one foot "dance" with the manikin, but otherwise seemed unable to make the connection of jumping while using the wooden body. Instead, he used the manikin to display sliding related behaviours, even though this had not been presented to him yet!

Why? Allard et al. (1993) reports one's ability to perform certain motor skills can facilitate one's knowledge about those motor skills. They found people who perform certain skills, are better able to know and understand the components of those activities than people who simply observe the particular motor act. Therefore, what you participate in seems to influence what you know about a motor skill. Rosenbaum (191) also comments, "Movement aids perception through means other than refreshing sensory receptors...the opportunity to move actively facilitates perceptual identification and memory" (p. 23). Was Rob able to display his knowledge of sliding behaviours with the manikin and tube

slide because he was used to sliding at home? Since sliding was a physical activity he could perform, he may have chosen to display this motion with the model of the human body rather than a jumping motion.

Even though Mosston and Ashworth (1994) support the use of dolls and models to display motor skills a child cannot perform physically, it seems a child still needs a clear understanding or mental representation of the skill to be displayed, in order to initiate physical performances or representational (with a model) performances. If John understood the task requirements, but did not know "jumping" or how to display the motion, then this implies cognitive processes are a critical part of skill acquisition in the psychomotor domain.

After the C&P teaching style for jumping was finished, the GP teaching format for sliding followed. As part of the prompts, the poster and simulated sliding action was shown. Immediately after this,

> *Rob ascended the slide on his own, sat with both legs extended in front of him, and waited for an additional prompt and help from me. I offered one finger and Rob took the offer. I wrapped my hand around Rob's wrist and he slid down the slide. Next, the cartoon card was shown and explained to Rob. He watched closely as I pointed to various features of the cartoon character. As soon as I asked him to show me sliding, he climbed up the slide by himself, and sat at the top. After a slight hesitation, he placed both hands correctly on the edge of the slide, and said, "Down." Then he began the short descent. His hands remained in the proper sliding position for half the descent, and then he lifted his hands off and spread them outwards and somewhat behind him.*

Rob's behaviours during the intervention were noticably different than the baseline activity observed the day before, Why this change? The dynamic systems theory would have difficulty explaining how changes in his motor behaviour occurred, since environmental conditions seemed similar to those experienced the day before and he had not grown so much overnight that the joints, bones, and other physiological components of motor control were effected. Granted, Rob's mother was absent during the intervention / dynamic assessment session, but, according to Kugler and Turvey (1987) and Kelso and Clark (1982), social conditions do not appear to influence motor behaviours. This is supported by Davis and van Emmerick (1995) and Sherrill (1993). In their description of ecological task analysis, which is patterned after dynamic

systems theory, they do not list social conditions as factors one can adjust to improve motor performances. Dynamic systems theorists would simply state changes were the result of previously unnoticed control parameters (VanSant, 1995; Wallace, 1996).

Although Adams (1971) would want to suggest that one feedback message adjusted the motor program via error detection, which resulted in more appropriate sliding behaviour, Rob appeared to alter his sliding behaviour *before* his descent. It was almost as if he had a new mental representation of the task, and that that concept influenced his sliding behaviour. Other sliding behaviours changed as well.

> *Later while participating in the GP format for sliding, Rob was shown the manikin and tube slide. Initially he seemed to want to push the tube slide away, however, once he saw the manikin descend the tube slide, Rob's attention became appropriately focused on the activity. I repositioned the wooden doll at the top of the tube slide, and Rob immediately pushed the doll down the slide, thereby initiating sliding motion. Over and over again, Rob took control of the manikin and sent the wooden doll down the tube slide with sliding motions. Each of these descents featured the doll with outstretched legs, sliding feet first. The arm position of the doll did not appear to matter to Rob, and he did not always place the doll in the tube with the face upwards. However, each descent was marked by a clear and simultaneous, "Weee." This purposeful sliding motion of the doll and concurrent ,"Weee" was repeated 14 times. Finally I asked him to show me how to slide. Rob stood up, took the wooden doll with him, and walked to the big plastic slide. While standing behind the plastic slide, he leaned forward, placed the doll with outstretched legs on the top platform of the slide, and pushed the manikin down the slide - feet first. Rob said, "Weee" as the doll slid down. Then, Rob climbed up the slide stairs, positioned himself at the top of the slide, placed his hands on the sides of the slide, and said, "Weee" as he descended. There was much laughter at the bottom.*
>
> *About one week later, when Ruth and Rob came to the final session at the indoor playground, Ruth mentioned that she had seen Rob sliding dolls down the little plastic slide at home.*

Rob's sliding behaviours seemed to change rapidly. Mentioned earlier in this chapter, Vygotsky's (1978) theory could explain that the changes were the result of interpersonal processes which became intrapersonal. Through the scaffolding of new information imbedded in the GP format, it appeared as if Rob

constructed an understanding of skillful sliding behaviour, and, that he showed this new understanding by exhibiting it personally and using dolls to portray sliding actions.

Rob showed gains in sliding related activities during the research period. This motor skill had been taught using the GP format. In addition, Rob seemed to display his knowledge of psychomotor behaviours using some of the GP teaching tools and strategies. However, Rob also showed distinct gains in jumping related behaviours during free-play one week after the intervention session. He had been taught jumping using the C&P teaching format. Therefore, it seemed as if both teaching formats did influence his psychomotor behaviours and understanding.

Pam

Pam's case was somewhat different from the others presented. At 5 years, 9 months, and 15 days of age, she was slightly older than the children initially targeted. Her acceptance into the project was discussed with others and permitted because fewer children joined the study than hoped, Pam was only 14 weeks older than the criteria permitted, she was still very small for her age -- even for a child with Ds, and Pam's mother, Faye, made persistent requests to join.

Faye, Pam, and the two younger brothers, one aged 40 months, and the other 12 months, were all present at the first visit. This was another busy family, where children were scheduled into various programs on a regular basis. Basic research information was shared, and Faye mentioned they had been to the playground research site about 15 times in the last four years. She also said Pam had very good sliding and jumping skills. Overall, with the exception of Pam's arm action while jumping (Wessel, 1976), this was confirmed during pre-assessment.

Pam's participation in the research period revealed an interesting pattern during free-play sessions. For example,

> *As soon as Pam arrived for the first pre-assessment session, she became involved in gross motor play. Pam began by climbing up the main foam ramp, sliding down the triple level circular slide, and crawling through*

tunnels to get to the small circular slide. She did this pattern three or four times, and eventually worked her way over to the far side of the playground equipment near the ball tarp and long triple slide. Once there, she maintained a very repetitive pattern of activity which included, climbing up a few small steps to get into the ball tarp, performing about 20 jumps to get across the ball tarp, crawling through several long tunnels, and sliding down the triple level slide. Then she would start again by climbing up the few steps into the ball tarp... After a few minutes of this, Pam saw a girl she knew, and together they worked their way throughout the playground equipment,using the same repetitive pattern of climbing, jumping, crawling, and sliding. This continued well after the 60 minute session, however, raw data was only collected for that period of time.

At the end of the first session, Faye said, "She was quite thrilled about coming... and she was really active! Like the minute I took her shoes off, she just went and played for the full hour... We stayed for about two hours in total. It was really good that she did it on her own - basically on her own without any companionship - because normally when we come, one of us (parents) will go with her through the tunnels and then slowly sort of wean her out of that companionship - so I was really surprised... She was anticipating and thrilled about coming and she just went independently.

During the day-later post-assessment session, Pam moved through the playground equipment using the same pattern of climbing up the steps into the ball tarp, jumping across it, crawling up tunnels and sliding down the triple level slide.

On the last day of the research project, which was actually one month after the intervention, Pam again moved using the same pattern through the playground, but with reduced intensity and with a much slower pace.

The repetitive pattern of play in preschool aged children with Ds has been documented previously by Beeghly et al. (1990). They investigated fine motor play of 35 children with Ds and 41 without Ds, during a 30 minute free-play session with their mothers. They found more repetitive play and repetition of schemes in the play patterns of children with Ds than in the play of the other children. Watkinson and Wall (1982) and Jobling (1996) also state that children with Ds play with similar objects in a repetitive sequence, and Jobling cites others (Gunn, 1982; McKonkey, 1985, Krakow & Kopp, 1982) who found identical patterns during fine motor play. Klager (1996) also saw repetitive tool use, perseverance, and rituals when observing people with Ds in art-making activities. However, no studies documenting gross motor play patterns of children with Ds were found.

As mentioned, Pam displayed a slower and less intense form of free-play during the final session. She seemed to favor her left foot in discrete ways. Pam was observed leaning on various objects and surfaces while jumping, standing and watching peers more than in other sessions, jumping less frequently, and rolling or pushing a large physio-therapy type ball around the play area. In addition, she did not seem as keen to run and crawl through tunnels and up ramps, and she took an extended snack break. While other factors may have caused this reduced gross motor play, it seems logical that her less intense gross motor play was a result of the foot injury she sustained a month prior.

Pam's case was also fascinating because it revealed her ability to display knowledge or interest in motor concepts using different forms of expression. As background, during the intial interview, Faye was asked if Pam could process and express information about sliding and jumping in ways other than speech and / or performing the specific gross motor activity. Faye said,

> *I don't know - - I have never really asked her ,....I don't really see her doing anything like that. No, I only hear speech, saying "slide down", or see her going down the slide. I guess that is the only method. Basically it's just speech,... I have never seen her express her knowledge in playing with models or drawing, I have never seen that.*

At the end of the final session, Faye was asked if she observed any activities or behaviors that seemed related to sliding and jumping during the research period She answered,

> *Not really anything in particular. I guess... Oh, she did some drawings at home that was... I guess... that resembled a slide. It was like a triangle, and she had the steps going up, and that's about it.*
>
> *I never ask her to draw.... I just give her a paper and ask her if she wants to do some drawing - I just supply the paper and the markers, and then the rest is just up to her to do what she wants to do - and she just does it on her own - so I don't know - I don't normally give her any verbal cue or anything like that.*

Next Faye was asked if Pam seemed to process and express information about sliding or jumping in ways other than speech and / or performing the specific gross motor activity, and if she did, what Faye came to learn and understand from her productions and activities. Faye said,

> *Because she drew a slide, I guess,.. because,.. since she drew it, it may*

show that she has a better understanding of the sliding process. You go up the steps and... the sequence that you go through in sliding, you go up the steps, then you slide down, basically from the top to the bottom, on a decline. I would think that's probably it... If I had to make a guess as to what or how she is processing information, that would be my best guess.

When Pam drew a picture of a slide spontaneously, Faye was surprised. However, Bertrand and Mervis (1996) report that six year olds can generally draw objects others can recognize. The fact she drew a picture related to sliding seemed more interesting. Was it coincidental that sliding was the motor skill Pam participated in using the GP format? Probably not. In a journal devoted to drawing development and artistry in special needs children, Golomb and Schemeling (1996) comment that in free drawing, the object drawn may be visually present or a representation of "reproductive memory" (p. 7), such as a memory image or the memory of a graphic schema of an object previously produced. Faye reported Pam drew the picture in the kitchen of their home; a concrete model of a slide was not present. Therefore, Pam's picture seemed to represent a memory image related to sliding; maybe it was the motion of sliding she thought about or a memory image of the various teaching tools used (i. e. cartoon cards). Without asking Pam immediately after picture production it is impossible to know. Others also report a strong relationship between free-drawing and representations of physical action.

Golomb and Schemeling (1996) conducted a two to three month "drawing and copying" study with children aged 7 to 20 years of age; nine had autism, eight had cognitive delay (four with Ds). Over four sessions, they found that instructions to draw a person, animal, table with something on top, or any other subject, did not result in great improvements. However, when drawings were requested of a person walking, running, climbing a ladder, and bending over to pick up a ball, this resulted in statistically significant gains in scores for both groups. Golomb and Schemeling suggest participants showed improvements in their ability to depict human action as a result of: 1) extrapolating "rules to meet new task demands, thus indicating a genuine capacity for self-initiated learning due to practice" (p. 15), 2) a function of the greater specificity of the assignment that motivated children to find a solution, or, because 3) "diverse tasks may

reveal different levels of performance, and thus of competence" (p. 16). Based on other findings previously reviewed, there may be a different reason.

Recall that Rosenbaum (1991) alluded to but Allard et al. (1993) found that motor skills one can perform influences what you know about those motor skills. Although their research did not include having subjects draw pictures of the motor activities, one may reason that requests to draw a human in action made more sense to the children than drawing a table, person, animal, or any other subject. Even though the children in Golomb and Schemeling's (1996) study probably knew what a table, person, or animal looked like, they may have had a stronger sense of the different components of human activity and how to represent this because of their likely participation in the various activities.

So, Pam's drawing of a slide may have been prompted by a mental image or memory of what sliding felt or looked like, or a recollection of the GPs used in the research. Golomb (1996) writes children's art work may reveal an inner mental life otherwise not easily documented. This may arise from visual thinking which leads to expressive art work. Others also suggest art: 1) supplies insights into visual thinking, 2) helps children recall and express memory, and process or modify observations; 3) represents pictoral concepts which pre-exist in one's mind; 4) serves as a symbolic language; and 5) serves to communicate ideas and express experiences (Gamradt & Staples, 1994; Ishii et al., 1996; Klager, 1996; Lindsay, 1972; Winner, 1996). Lund (1994) adds, "Drawing, writing, and talking are ways children choose to explore, clarify, and document their interests, speculations, and ideas" (p. 20). Artwork may serve to give events or things meaning and art may provide a self-guided opportunity to focus on images and experiences children themselves select -- becoming an idea-keeper of their thinking. If so, Pam's spontaneous drawing of a slide may have served to help her rethink, reflect, remember, or reconstruct activities she was involved in before. Vygotsky (1978) proposes that such external behaviours reveal what internal connections have been made.

In addition to Pam's self-initiated artwork, she responded to intervention / dynamic assessment and post-intervention tasks using methods other than physical activity alone -- usually she responded with finger gestures or verbal expressions. The case study notes reveal that

Pam responded to the various GPs for sliding on her own, sometimes initiating words and labels such as, "slide", "slide down", or saying her name when she saw the laminated paper doll of herself. Pam also 'slid' her hand along the slide in the sliding poster without guidance, positioned her legs wide apart and straddled over the edge of the slide, after seeing the cartoon card prompt of the character in the slide with legs wide apart. Another time, after seeing the manikin and tube slide demonstration, Pam wanted to manipulate the doll's arms, legs, and trunk for the second demonstration. When the manikin was positioned correctly, Pam picked up the end of the slide, and let the doll glide down with the pull of gravity. Then, when asked to show me sliding skills, she took the wooden doll with her to the big plastic slide, climbed up the slide stairs, stopped part way up, carefully placed the manikin on the slide, and nudged it forward to begin the descent.

During post-intervention tasks for sliding, Pam responded to each task immediately and independently. She pointed, made gestures, used single words, said, "No" when certain cards were incorrect, and mastered the cartoon series task. For example, when asked to make a story about the cartoon cards after she mastered the series task, she answered with short word phrases. For each card, I prompted her with, "What is Pam doing here?" As I pointed to each card in turn, Pam responded, "Slide down," "Going up," "Slide down," and "Sitting." All answers corresponded exactly to the action displayed by the figures, except for card #1. Her response then may have been a form of pre-motor planning, or an indication that she remembered how I had explained the task initially.

Pam answered post-intervention tasks for jumping in similar ways. She said, "Jump," and gestured motions with her finger, which corresponded to the various activities children were doing in each picture. In the picture of the child walking up some steps, Pam tapped her finger along the card in an upward motion. She also made an up / down motion with her finger to show that the child in the next picture was jumping, moved her finger along the balance beam in the picture that showed a boy doing that activity, and moved her finger in a downward sliding motion, on the picture of the girl who was sliding down a slide. On another task, when asked, "Who is not jumping?", Pam again motioned and gestured, using her finger, to show what individual children were doing in each picture. And, finally, when asked to display her knowledge of jumping action with a manikin and a pillow, Pam placed the wooden doll upright on the pillow, jumped it numerous times, and used words to describe this action.

These examples show Pam's willingness and ability to display knowledge of various experiences and concepts using assorted forms of expression. Eisner (1982) refers to the value of using different techniques to express knowledge

and communicate with others. He writes experiences are private and remain that way until sharing makes them public. Experiences are made public through forms of representation and these are used to convey what has been conceptualized. Eisner adds, just as qualities of experiences are multiple in form and meaning, so too are expressive skills because different forms of representation emphasize different sensory perceptions and responses require different psychological processes. To experience different forms of consciousness, people need opportunities to interact with different mediums. If one is trying to develop movement consciousness, children must be able to express through forms of movement (p. 51). This is also supported by Hartley et al. (1952). They write that for those who are preverbal or who have difficulty using words to express comprehension of concepts, "modes of expression must be offered which will be consonant with their experiences and capacities..." (p. 6). Adults need to remember,

> that for the child, his body is an organ of expression as well as perception, and that his attitudes toward himself and the world about him are expressed in the way he uses his body more fully than his verbalizations" (p. 7).

Cadwell and Fyfe (1997) and Abramson et al., (1995) also comment that movement is considered one of the ways in which a child can express their knowledge. Pam seemed very purposeful in choosing to use gestures as a form of expression during the intervention and post-intervention tasks. In a manner that she was comfortable with, she used movement based forms of representation to display her knowledge of psychomotor concepts.

It may be worth noting that Pam, the oldest child in the research, responded to each post-intervention task correctly. Since each other child in the research project was able to get some of the post-intervention answers right, this seems to suggest the tasks were within the range of knowledge about motor skills for preschool aged children with Ds. Cowden and Torrey (1986) comment that it is important to present children with tasks that are not too simple. Tests "should be devised so that children fail at some of the tasks rather than being allowed to reach a ceiling level" (p. 33).

It seems unfair to comment on Pam's changed psychomotor behaviours

and understandings during the research period considering that she was slightly older than the other research participants, her gross motor skills were quite good to begin with, and since her participation in the study was extended due to her unique medical condition. Nevertheless, Pam's case showed her ability to use different forms of representation in expressing her knowledge of psychomotor concepts and to respond to all the post-intervention tasks correctly. Therefore, this made her an extremely valuable asset to the study

Summary

Seven preschool aged children with Ds participated in a case study research design to investigate modifiability of the psychomotor domain. While every child displayed many unique responses to the research activities, only three or four highlights of the findings of each child's case study were featured in the descriptions. Overall, it appeared as if individual children made gains in their psychomotor learning and development after participating in the two different forms of intervention -- the C&P and the GP format. However, it appeared that more noticeable differences in the psychomotor behaviours of each child were due to participation in the GP intervention format which utilized cognitive processes.

Pre- and post-intervention differences in psychomotor behaviours were observed at the research site. These observations were confirmed by parent(s) through independent journaling of their child's psychomotor behaviours at home. Commonly accepted motor learning theories were unable to account for the findings. However, aspects of Vygotsky's (1978) social-historical theory of cognitive development, which seemed to relate to this research, were discussed in relation to the child's psychomotor behaviours and activities. Additional theories and literature were also presented to support or refute children's self-initiated behaviours and / or other responses to the various research activities.

The following section describes other patterns of behaviours and responses that emerged as a result of cross case analysis.

CHAPTER FIVE

CROSS-CASE ANALYSIS AND RELATED DISCUSSIONS

Introduction

This section highlights patterns of similarities across individual cases. Two main findings are presented and discussed in relation to the literature. One topic describes the observed differences in children's psychomotor behaviours, and the other topic pertains to the children's reactions to and interactions with the various teaching formats. Other interesting trends are also reported.

Qualitative Differences in Psychomotor Behaviours

Each child involved in the research project displayed changed motor behaviours during the eleven day period of study. Information in this section will center on observed sliding and jumping related activities, as those were the two motor skills studied. The initial cross case analysis will focus on changes observed at the research site; thereafter, comparisons based on the findings reported by parents will be described.

Some changes were observed at the research site on the day after the intervention / dynamic assessment session[3], while other changes occurred one week later. For example, several children exhibited more frequent sliding and / or jumping related behaviours, some children showed a "more advanced" form of a sliding or jumping activity, while others displayed a decrease in motor activity after the intervention session. In general, any gains made were minute.

Information about the child's free-play behaviours was gathered throughout the research period as described in the Methods section, and tallied on checklists depicting progressively more mature sliding and jumping skills levels (refer to Table 6 on p. 84). Because "teaching format" was a topic being investigated, checklist data (converted into Tables) are identified according to the type of teaching style used and the motor skill being judged. Based on random selection, four children participated in C&P for sliding and GP for jumping, while three children participated in the reverse formats. Information is presented in order from youngest to oldest child in each table. Results

3. Rob and John performed their Day-Later post-assessment sessions immediately after the intervention session to accommodate their parent's schedules.

displaying observed frequency and levels of competence of the motor skills performed are recorded in Tables 7-10.

Table 7.

Number of Free-Play Sliding Activities per Child, Before and After Command and Practice Teaching Intervention for Sliding

Name, age, & skill levels	Pre	One hour Assessment Periods Post -Day Later	Post -Week Later
Carol, age: 2 years, 10 months, 2 days			
Level A	4	11	12
Level B	16	6	10
Level C	-	1	-
Level D	-	-	1
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**20**	**18**	**23**
Ali, age: 3 years, 10 months, 12 days			
Level A	1	2	5
Level B	15	19	14
Level C	2	1	-
Level D	-	-	-
Level E	-	-	2
Level F	-	-	3
TOTAL FREQUENCY:	**18**	**22**	**24**
Sue, age: 3 years, 11 months, 5 days			
Level A	5	4	3
Level B	16	11	10
Level C	1	-	-
Level D	-	-	-
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**22**	**15**	**13**
John, age: 3 years, 11 months, 6 days			
Level A	1	8	11
Level B	12	16	7
Level C	2	-	-
Level D	-	2	6
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**15**	**26**	**24**

Table 8.

Number of Free-Play Jumping Activities per Child, Before and After Command and Practice Teaching Intervention for Jumping

Name, age, & skill levels	Assessment Periods: Pre	Post -Day Later	Post -Week Later
Lisa, age: 3 years, 5 months, 20 days			
Level A	-	-	6
Level B	6	12	13
Level C	-	-	-
Level D	-	-	-
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**6**	**12**	**19**
Rob, age: 4 years, 8 months, 10 days			
Level A	1	-	7
Level B	1	1	38
Level C	-	-	3
Level D	-	3	26
Level E	5	2	28
Level F	-	-	-
TOTAL FREQUENCY:	**7**	**6**	**102**
Pam, age: 5 years, 9 months, 15 days* (fractured her leg in post-intervention period)			
Level A	-	3	1
Level B	-	17	-
Level C	-	-	25
Level D	163	65	5
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**163**	**85**	**31**

Table 9.

Number of Free-Play Jumping Activities per Child, Before and After Graduated Prompt Teaching Intervention for Jumping

Name, age, & skill levels	Assessment Periods: Pre	Post -Day Later	Post -Week Later
Carol, age: 2 years, 10 months, 2 days			
Level A	2	12	35
Level B	1	42	100
Level C	-	-	-
Level D	-	-	-
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**3**	**54**	**135**
Ali, age: 3 years, 10 months, 12 days			
Level A	2	3	-
Level B	5	27	19
Level C	3	-	5
Level D	17	13	7
Level E	1	119	64
Level F	-	-	-
TOTAL FREQUENCY:	**28**	**162**	**95**
Sue, age: 3 years, 11 months, 5 days			
Level A	3	10	5
Level B	40	43	35
Level C	3	41	28
Level D	-	3	4
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**46**	**97**	**72**
John, age: 3 years, 11 months, 6 days			
Level A	1	9	2
Level B	34	35	27
Level C	79	-	-
Level D	112	89	176
Level E	-	-	5
Level F	-	-	10
TOTAL FREQUENCY:	**226**	**133**	**220**

Table 10.
Number of Free-Play Sliding Activities per Child, Before and After Graduated Prompt Teaching Intervention for Sliding

Name, age, & skill levels	Assessment Periods: Pre	Post -Day Later	Post -Week Later
Lisa, age: 3 years, 5 months, 20 days			
Level A	-	1	-
Level B	32	24	13
Level C	-	-	-
Level D	1	-	-
LevelE	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**33**	**25**	**13**
Rob, age: 4 years, 8 months, 10 days			
Level A	1	-	2
Level B	15	8	3
Level C	2	1	1
Level D	3	2	3
Level E	2	2	4
Level F	-	1	2
TOTAL FREQUENCY:	**23**	**14**	**15**
Pam, age: 5 years, 9 months,15 days* (fractured her leg in post-intervention period)			
Level A	15	6	6
Level B	1	10	6
Level C	3	7	-
Level D	19	6	8
Level E	-	-	-
Level F	-	-	-
TOTAL FREQUENCY:	**38**	**29**	**20**

Children's Changed Motor Behaviours During Free-play

Unless indicated otherwise, each child remained in the large playground area for the "Post-Day Later" and "Post-Week Later" free-play trials; this was the same location in which the Pre-Assessment free-play session was conducted.

All children displayed some type of sliding and jumping related activity across all freeplay sessions, and the proficiency of motor skills observed varied widely. In general, children displayed more jumping-type behaviours than sliding-type behaviours. Younger children performed less of and more immature forms of the various motor skills than the older children. Changes in

the frequency and / or competency of free-play sliding and jumping related movements were noted after the dynamic assessment session.

Since the goal of this research was to investigate modifiability of the psychomotor domain by focusing on the "process" of motor skill acquisition, changes in the frequency of motor skills observed during free-play will not be discussed. Frequency of movement is considered a "product" or outcome rather than a process (Burton & Miller, 1998). In contrast, the "process" of motor skill acquisition is evidenced through increases in levels of competence -- positive changes in movement patterns (Burton & Miller; Sherrill, 1993; Sparrow, 1992). During the free-play sessions at the large playground, five of the seven children were observed performing more proficient motor skills after participating in the intervention / dynamic assessment session.

For example, after participating in the C&P teaching format for sliding, Carol showed a more "advanced" pattern of that motor skill as time progressed. Her pre-assessment free-play sliding related activities consisted of: looking into and playing in slide exits, saying, "Down tummy," as she did backwards tummy slides down stairs, one bum scoot, and numerous tummy slides. During the "Day-Later" free-play session, Carol displayed many of the same sliding related activities, but she also sat upright and was assisted down the slide by her mother. One week later, Carol sat upright with her legs slightly apart, and descended a slide independently. Carol's mother reported that she had never seen this before.

Ali also showed improvements in skill maturation of sliding, with greatest gains during the final free-play session. This skill had been encouraged using the C&P format during the intervention session. Ali's initial sliding related behaviours included: looking into a slide exit, doing three bum scoots, three bum slides, and numerous backwards tummy slides. She also slid down a slide with support. Similar skills were displayed during the "Day-Later" session. However, on the last day, in addition to the more elementary forms of sliding, she also slid independently two times in a forward sitting position with her arms and legs in proper position. Then she performed three slides in a more daring manner -- sliding independently while sitting forward with her arms stretched forward and outward (as if wanting to achieve a thrilling effect as when on a

roller coaster).

John's case showed increases in competence for both sliding and jumping. Sliding was taught using the C&P format, and jumping was taught using the GP method. In regards to sliding related behaviours, during the pre-assessment session John looked into the slide exit once, did numerous backward tummy slides and bum scoots, and he performed two slides while assisted by his father. However, during the "Day-Later" and "Week-Later" sessions, John slid down slides independently with his legs slightly apart. He did this in the "toddler area" of the playground, which meant he descended much smaller and shorter slides. Nevertheless, this was considered a positive gain in that he performed the skills without the assistance of his parents. On the other hand, John's initial jumping behaviours included the use of the word "jump", falling-forward motions, bum bounces, one foot step downs, supported up / down motions, and numerous unassisted jumps that corresponded to Level D in Table 6 (i. e. any independent up / down motion which resulted in jumps of 1-2 inches, and bending knees or lifting arms up / out). One week after the intervention / dynamic assessment session, John displayed more advanced jumping forms. Data from John's case showed that he performed several precursors to jumping which were similar to those he displayed during the initial free-play session, but he also displayed five unassisted jumps with bent knees and active arm motion that began from a ready position. These jumps were 2.5 to 5 inches in height. In addition, John performed ten wild and twisty jumps on a trampoline. According to his parent, these were purposeful movements that were much more energetic and daring than his typical jumping behaviours and therefore considered gains in proficiency.

Sue exhibited an increase in the maturation of her jumping ability after participating in the GP form of intervention for that skill. During the pre-assessment, Sue said "jump" once, watched peers jump, and looked into the jumping area. In addition, she did several bum bounces, high stepping activities on the trampoline surface, several one foot steps off a mattress, made other small up / down motions, and did three jumps with assistance. During the "Day-Later" session, Sue performed different jumping related behaviours. She said "up, jump" nine times, played with the jumping props, performed many up /

down motions, bum drops and other precursors, jumped with assistance, showed jumping using the teaching dolls / models, and she jumped without assistance three times to a height of 1 - 2 inches. One week later, she also said, "Up, jump, bounce" numerous times, performed similar precursors, showed jumping with the use of the dolls / models again, and performed four unassisted jumps to a height of 1 - 2 inches.

Rob showed more advanced levels of sliding after participating in the GP format for sliding. To begin with, Rob performed numerous bum scoots, backward tummy slides, forward sitting sliding motions, several slides with good arm or leg position, and two slides with good leg and arm position. During the "Day-Later" session, Rob performed similar sliding behaviours plus a few new skills. For example, he used the wooden manikin to portray sliding motion, he slid with support, and he slid in more daring ways -- sliding backwards on his stomach with one leg purposefully positioned over the edge of the slide (as if he was half falling off the slide). One week later, John spontaneously used sliding related words and performed fewer bum scoots and backward tummy slides. In addition, he slid with support, slid independently with good leg position only, used the manikin to portray sliding, and did four independent slides of good form. During this last free-play session, John also performed two daring slides -- one with the leg positioned over the edge of the slide as he slid down backwards (again as if falling off the slide), and another slide where he was sitting forward, but purposefully lifted his arms up and outwards (as in roller coaster fashion).

The cross-case analysis of changes in motor behaviour during free-play, revealed that after participating in the C&P teaching format, three children increased in proficiency of sliding skills. For the GP format, two children displayed more advanced jumping related behaviours, while one child showed improvements in sliding behaviours. These results do not permit one to infer that one teaching method was more beneficial than another. However, parents also reported qualitative differences in their child's motor behaviours at home. Their accounts seemed to provide support for the positive effects of one teaching format over another.

Parent's Observations of Children's Sliding and Jumping Related Behaviours

Parents were asked to document their son's or daughter's spontaneous sliding and jumping related behaviours during the research period. All wrote or said they observed their child playing with toys, drawing, or performing / engaging in behaviours which suggested that their child was representing a motor skill in ways not previously evidenced by the parent. The parents did not know which motor skill was taught using which teaching style; however, for ease of discussion in this paper, and because a surprising trend arose during this cross-case analysis, that information is also presented in Table 11.

Table 11.
Parent Documentation of Spontaneous Research-Related Play at Home

Child's Name Motor Skill / Teaching Format Used	Spontaneous Play at Home or other Settings
Carol	
Jumping / Graduated Prompt	Made dolls and teddy bear crackers jump many times Lots of bouncing on things, using upper body more Made jumping motions, trying to get up on her toes More speech about the activity, says "Jump" alot!
Sliding / Command & Practice	Made dolls slide down slides Doing alot of sliding - still needs help to slide down
Lisa	
Sliding / Graduated Prompt	Several slides down with both hands on the sides Slid down the slides at church Slid dolls down slides at church very frequently
Jumping / Command & Practice	Bounces when sitting down, on bed, with music, TV Tried bouncing up on her toes several times Stood on coffee table and tried jumping to mom's lap Raising hands before trying jumping motion
Ali	
Sliding / Command & Practice	-0-
Jumping / Graduated Prompt	Jumping off sofa - from cushions to ground Seems more courageous in her jumping Climbed up and over the back of the couch She'll make actions like she wants to do jumping

Continued on next page...

Child's Name Motor Skill / TeachingFormat Used	Spontaneous Play at Home
Sue	
Sliding / Command & Practice	Talking to her brother about slides, says "Whee" ? Was sitting up while sliding, she used to lean back
Jumping / Graduated Prompt	Says "Bounce, bounce" alot and jumps on things Seems more relaxed about physical activity Does actions and words at the same time "Bounce..." She drew a picture of jumping, said "Bounce bounce" with her crayon, and made many dots on paper Put dolly on floor, bounced on it's head Goes up on her tip toes more often
John	
Jumping / Graduated Prompt	Lots of dancing and jumping in front of TV Instead of sliding, is jumping off swimming pool slide When "Time for Bonkers", he started to jump alot Is jumping on his own now - used to do it only with Dad Wants to show mother how he is jumping Is making four teletubby toys jump all over the place!
Sliding / Command & Practice	-0-
Rob	
Jumping / Command & Practice	Seems to be jumping more, down stairs, off curbs, on bed, in the bathtub, on a wagon, infront of TV Does not jump on feet - lands on his bottom
Sliding / Graduated Prompt	Slides in turn with little brother at home, says "You go!" Tossed dolls down slide at home
Pam	
Sliding / Graduated Prompt	Made a drawing that resembled a slide
Jumping / Command & Practice	-0-

The data presented in Table 11 reveals that each child initiated some sliding and / or jumping related behaviour at home, and engaged in play and / or activities related to the motor skill taught using the GP format. Some children seemed to prefer performing motor skills with their whole body, others used three dimensional objects to depict physical activity or related concepts in their spontaneous play, while some others exhibited both types of play.

The type and amount of play activity performed by each child seemed more related to one teaching style than the other. For example, Lisa and Rob's mothers felt they initiated more jumping activities at home; both children were taught jumping skills using the C&P format. In addition, a few children seemed to use concepts which were taught using the GP format, and later apply them to skills taught using C&P -- as if constructing a new understanding of the "other" motor skill and expressing this knowledge. However, overall, it appears more children voluntarily displayed their understanding of the motor skill taught using the GP format than those taught using the C&P teaching style.

After reviewing individual case studies and conducting a comparison of the children's changed psychomotor behaviours, it appeared that each child had constructed their own connection between one or more of the different GPs that were used during the dynamic assessment, and some form of jumping or sliding. Some motor behaviours were performed by the child his / herself, while other activity seemed more symbolic.

Discussion Regarding Qualitative Differences

Some research outcomes correspond to previous findings in the literature, while others do not. For example, the variability of motor skills in children with Ds and the fact young children with Ds generally display more elementary forms of motor behaviour than older children with Ds has been well documented (Block, 1991; Carr, 1970 Connolly & Michael, 1986; de Graaf, 1995; Dmitriev, 1988a; Dyer et al., 1990; Fishler et al., 1964; Harris, 1984; Lauteslager, 1995; Niman-Reed & Sleight, 1988; Spiker, 1990; Winders, 1997; Zausmer, 1978a; Zausmer & Shea, 1984). Although spontaneous gross motor play of children with Ds is encouraged as a way to document a child's interest in and current motor ability in various skills (Watkinson & Wall, 1982), results of such assessments were not found in the literature. Indeed, it appears little has been documented about the relationship of gross motor skill acquisition in play. Beeghly et al. (1990) write, "Play proved to be an excellent context in which to study social, emotional, cognitive, and linguistic aspects...of development [in children with Ds]" (p. 362). The motor component is clearly absent.

There is limited information about the spontaneous gross motor play patterns of preschool children (Ellis, 1979; Johnson et al., 1987), and especially the gross motor play patterns of preschoolers with Ds (Block, 1991; Jobling, 1996; Rynders, 1987; Sherrill, 1993). Frost (1992) reports that certain pieces of playground equipment can positively effect motor skill development / muscular endurance and children are significantly more active when free to play on well developed playgrounds than if involved in a structured physical education class. However, he adds that even in free-play, "children with poorly developed skills need more encouragement and direction by adults" (p. 47). This seems to correspond to Wessel (1980b) and Watkinson and Wall's (1982) curricula which appear to assume that spontaneous play does not frequently occur with preschoolers with cognitive delays. These two references have documented strategies teachers should use to get children to engage in free-play. Bailey and Wolery (1984) also report, "Early childhood special educators know that high rates of voluntary engagement are not observed in young handicapped children" (p. 131). This was not evident in this research.

Each child self-initiated free-play activity during the various assessment sessions and, for the most part, needed little direction from adults[4]. In addition, the children typically continued in gross motor play and exploration for sixty minutes at a time.

The spontaneous interest in gross motor play and exploration corresponds to earlier findings by Kamps (1996) in which she observed preschoolers with Ds performing gross motor play in a different setting than the playground used for this research project. As part of her study on the efficacy of a structured program on fundamental motor skill development, Kamps videotaped the children four different times during gross motor free-play throughout a 20 week period. She reported all 18 children displayed an intense interest in and continuous movement throughout the gross motor play area. Each child moved independently, self-initiated exploration on numerous pieces of equipment, moved in various spatial planes, and interacted with peers upon occasion. In addition, several emerging motor skills were identified and many movements involved sequential

4 Two children had prompting by parents during post-assessment sessions. They may not have needed it; the parents simply encouraged their child to 'get started', or "Go play".

motor tasks. Some children also performed skills and activities related to, but not previously observed during their participation in the adult-led structured program of gross motor development.

One interesting aspect of the changed psychomotor behaviours was that some children seemed to display greater increases in sliding and jumping related behaviours one day after the intervention session, while others seemed to show gains one week later. Why? French and Nevett (1993) explain even with simple motor tasks, children generally select and organize responses slower than adults. For children with Ds, responses are even slower (Beeghly et al., 1990; Canning & Pueschel, 1978; Connolly & Micheal, 1986; Connolly et al., 1984; de Graaf, 1995; Eichstaedt & Lavay, 1992; Harris, 1984; Mattheis, 1995). Schmidt (1991) also reports, those who facilitate skill learning and development must be cognizant that the "level of performance while the subject is learning the task may not reflect the amount that he is learning" (p. 77). Therefore, whether results are evident immediately or more delayed, Schmidt's research suggests learning is ongoing. Differences in the time required by each child to display their gross motor responses may have been due to individual attributes of each research participant.

Overall, the data revealed some increases, decreases, and consistent responses in either frequency or ability for both motor skills during free-play behaviours after the intervention session. Even though LeBlanc and Dickson (1996) write, "Children have a natural tendency to push their limits, to see how fast they run or how far they can climb" (p. 109). It is impossible to claim that gains in frequency and / or ability of sliding and jumping behaviours during free-play were the result of various interventions used, since free-play behaviour is generally internally directed (Johnson et al., 1987) and therefore, children will not necessarily perform specific motor skills in a more mature form (Ellis, 1979). Nevertheless, since the observation of children's play provides a way to measure their independent functioning (Cunningham, 1988; Linder, 1993; Watkinson & Wall, 1982; Wessel, 1980a, 1980b) and based on Vygotsky's (1978) assumption that children play at the upper-end of their development, it follows that new independent abilities displayed during free-play opportunities may indicate gains in psychomotor activity. Since some children's play patterns

revealed gains in motor skill ability after the intervention session, one may infer that the psychomotor domain was modified.

Efficacy of the Teaching Formats

Information just presented suggests that the alternate teaching styles may have benefited the children differently. This inference is based on observed data which revealed differences in the frequency and competency of sliding and jumping related behaviours during free-play sessions, as well as the parent's documentation of related psychomotor behaviours. However, before using this information as the sole basis for determining the efficacy of the two different teaching formats, other responses which occurred during the intervention session will be reviewed. Additional information includes data which displays each child's effort and willingness to engage in the different teaching formats and their frequency of spontaneous interactions with the various teaching tools. Thereafter, all information will be considered collectively in a discussion about what appears to be the most effective teaching methods to use, when working with preschoolers with Ds while facilitating gross motor skill acquisition.

Children's Willingness to Engage in the Different Teaching Formats

Table 12 displays much data. Two columns indicate which motor skill was taught with which teaching format for each child. Other information shows each child's response to four tasks: the parent's requests to perform two baseline skills, and the six trials each for the GP teaching format and the C&P tasks. Children's responses were coded as "Cooperative" if they responded to the task / request on their own. This also included situations in which the child needed one or two additional verbal prompts. If, on the other hand, the child was unwilling to respond as requested, turned away, or wanted to leave the equipment or area in which the task was to be performed, and they could not be pursuaded otherwise, this was considered a "Refusal". Children are listed from youngest to oldest within the Table. An asterick indicates that physical support was provided by another person to help the child complete the motor task.

Table 12.
Child's Willingness to Cooperate in Various Research Activities.

Name		Baseline Skills: Slide / Jump	Interventions and Motor Skills: Graduated Prompts	Interventions and Motor Skills: Command & Practice
Carol		Refusal / Cooperative*	Jump	Slide
	Trial 1		Cooperative*	Cooperative*
	Trial 2		Cooperative	Cooperative*
	Trial 3		Cooperative	Cooperative*
	Trial 4		Cooperative	Refusal
	Trial 5		Cooperative	Refusal
	Trial 6		Cooperative*	Refusal
Lisa		Refusal / Refusal	Slide	Jump
	Trial 1		Refusal*	Cooperative
	Trial 2		Cooperative*	Cooperative*
	Trial 3		Cooperative*	Cooperative*
	Trial 4		Cooperative*	Cooperative*
	Trial 5		Cooperative	Cooperative*
	Trial 6		Cooperative*	Cooperative*
Ali		Cooperative* / Refusal	Jump	Slide
	Trial 1		Cooperative	Cooperative*
	Trial 2		Cooperative	Cooperative*
	Trial 3		Cooperative	Cooperative*
	Trial 4		Cooperative	Cooperative*
	Trial 5		Cooperative	Cooperative*
	Trial 6		Cooperative*	Cooperative*
Sue		Cooperative / Cooperative	Jump	Slide
	Trial 1		Cooperative*	Cooperative*
	Trial 2		Cooperative	Cooperative*
	Trial 3		Cooperative	Refusal*
	Trial 4		Cooperative	Refusal*
	Trial 5		Cooperative	Cooperative*
	Trial 6		Cooperative	Cooperative*
John		Cooperative* / Refusal	Jump	Slide
	Trial 1		Cooperative*	Refusal*
	Trial 2		Cooperative	Refusal
	Trial 3		Cooperative	Refusal
	Trial 4		Cooperative	Refusal
	Trial 5		Cooperative	Refusal
	Trial 6		Cooperative	Refusal

Continued on next page...

Name		Baseline Slide / Jump	Interventions and Motor Skills Graduated Prompts	 Command & Practice
Rob		Refusal* / Refusal*	Slide	Jump
	Trial 1		Cooperative*	Refusal
	Trial 2		Cooperative	Refusal
	Trial 3		Cooperative	Cooperative
	Trial 4		Cooperative	Cooperative
	Trial 5		Cooperative	Cooperative
	Trial 6		Cooperative	Cooperative
Pam		Cooperative / Cooperative	Slide	Jump
	Trial 1		Cooperative	Cooperative
	Trial 2		Cooperative*	Cooperative
	Trial 3		Cooperative	Cooperative
	Trial 4		Cooperative	Cooperative
	Trial 5		Cooperative	Cooperative
	Trial 6		Cooperative	Cooperative

* Indicates physical support from other person (i. e. "Cooperative*"means the child cooperated but needed or wanted assistance. "Refusal*"means the child originally refused, but eventually completed the task with assistance.)

Several trends emerged when comparing the children's responses to the various research activities. Only two of the seven children cooperated fully with the parent's request to perform both baseline skills and younger children seemed to want or need more physical support with the various research tasks than older children. In addition, with the exception of one trial, all children were cooperative when participating in the GP teaching style, four children refused some of the C&P trials, and more children needed or wanted assistance when participating in the C&P teaching style. Another finding revealed in the case study descriptions was that several children who participated in the C&P format seemed somewhat disjointed in their motor productions. For example, Lisa, Rob, and Pam seemed to attend to single aspects of the motor task while jumping; Lisa focused on her arm movements, Pam on her knees, and Rob seemed to concentrate on the "springing" action of his legs.

When responding to the GPs younger children appeared to require or want less support and assistance than when responding to the C&P format, however, each child did use adult support for at least one of the GPs. On the whole, all seven children were cooperative in response to all six GPs, and there was a

general sense of attentiveness and interest when they were presented. Except for Lisa, who refused the initial prompt, each child responded to all six GP trials by displaying a version of jumping or sliding when asked, remaining physically active for a longer time after each of the trials was presented, and showing a willingness to engage in an interpersonal information exchange during each trial. Lisa had a very bad head cold and was extremely unhappy when her mother dropped her off at the research site for the intervention session. Interventions did not begin immediately after Lisa's mother left, but even with a three or four minute delay, she was unwilling to engage during the initial GP. Based on her mother's request to be consistent with other program practices and have Lisa do as she was told, she was assisted in her first task. After a four or five minute break, during which time she settled, the GPs re-sumed and Lisa cooperated and focused well for the remainder of the prompts.

Children's Spontaneous Interactions with the Various Teaching Tools

Six different teaching prompts were used during the GP intervention for this investigation. The GPs, developed by the parents and researcher, utilized various combinations of verbal and visual cues, with or without demonstrations. Verbal commands and the opportunity to practice six times were methods used for the C&P format -- to duplicate teaching formats which are common in motor development programs. During the "Day-Later" and "Week-Later" sessions, the six different teaching tools were placed on the floor in the intervention room to see if the children would interact with them spontaneously. Table 13 displays the data corresponding to this activity. Information is organized according to three different research activities: the intervention session, the "Day-later", and the "Week-later" post-assessment periods. The actual teaching interaction is recorded as one event for each teaching tool. Astericks behind all six prompts per child, indicates that the motor skill (sliding or jumping) was taught using the GP method. If no astericks are indicated behind the various teaching tools, this indicates that the motor skill was taught using the C&P format.

Table 13.

Number of Spontaneous Uses of Graduated Prompt Teaching Tools* During Intervention (Intv), Day-Later (D-L) and Week-Later (W-L) Post-Assessments

Child's Name Teaching Tools-Slide	Intv	D-L	W-L	Teaching Tools-Jump	Intv	D-L	W-L
Carol							
1 Poster of slide	0	0	1	1 Poster of jumping room*	1	0	0
2 Cartoon girl sliding	0	0	0	2 Cartoon girl jumping*	1	0	0
3 Picture - child sliding	0	0	0	3 Picture - child jumping*	1	0	0
4 Front view paper doll	0	0	0	4 Side view paper doll*	1	0	0
5 Manikin & tube slide	0	0	1	5 Manikin & pillow / jumps*	1	0	7
6 Adult demonstration	0	0	0	6 Adult demonstration*	1	0	0
Lisa							
1 Poster of slide*	1	0	0	1 Poster of jumping room	0	0	0
2 Cartoon girl sliding*	1	0	0	2 Cartoon girl jumping	0	0	0
3 Picture - child sliding*	1	0	0	3 Picture - child jumping	0	0	0
4 Front view paper doll*	2**	0	0	4 Side view paper doll	0	0	1
5 Manikin & tube slide*	4	1	0	5 Manikin & pillow / jumps	0	0	4
6 Adult demonstration*	1	0	0	6 Adult demonstration	0	0	0
Ali							
1 Poster of slide	0	0	0	1 Poster of jumping room*	1	0	0
2 Cartoon girl sliding	0	0	0	2 Cartoon girl jumping*	1	0	0
3 Picture - child sliding	0	0	0	3 Picture - child jumping*	3	0	0
4 Front view paper doll	0	0	0	4 Side view paper doll*	7	0	0
5 Manikin & tube slide	0	0	0	5 Manikin & pillow / jumps*	30	0	0
6 Adult demonstration	0	0	0	6 Adult demonstration*	1	0	0
Sue							
1 Poster of slide	0	0	1	1 Poster of jumping room*	1	0	0
2 Cartoon girl sliding	0	0	0	2 Cartoon girl jumping*	1	0	0
3 Picture - child sliding	0	0	0	3 Picture - child jumping*	5	0	0
4 Front view paper doll	0	0	0	4 Side view paper doll*	18	0	0
5 Manikin & tube slide	0	3	1	5 Manikin & pillow / jumps*	1	16	3
6 Adult demonstration	0	0	0	6 Adult demonstration*	1	0	0
John							
1 Poster of slide	0	0	1	1 Poster of jumping room*	1	0	1
2 Cartoon boy sliding	0	0	0	2 Cartoon boy jumping*	1	0	0
3 Picture - child sliding	0	0	0	3 Picture - child jumping*	1	0	0
4 Front view paper doll	0	0	0	4 Side view paper doll*	1	0	0
5 Manikin & tube slide	0	0	0	5 Manikin & pillow / jumps*	1	0	0
6 Adult demonstration	0	0	0	6 Adult demonstration*	1	0	0

Continued on next page...

Child's Name Teaching Tools-Slide	Intv	D-L	W-L	Teaching Tools-Jump	Intv	D-L	W-L
Rob							
1 Poster of slide*	1	0	0	1 Poster of jumping room	0	0	0
2 Cartoon boy sliding*	1	0	0	2 Cartoon boy jumping	0	0	0
3 Picture - child sliding*	1	0	0	3 Picture - child jumping	0	0	0
4 Front view paper doll*	1	0	0	4 Side view paper doll	0	0	0
5 Manikin & tube slide*	3	1	1	5 Manikin & pillow / jumps	0	0	0
6 Adult demonstration*	1	0	0	6 Adult demonstration	0	0	0
Pam							
1 Poster of slide*	1	1	1	1 Poster of jumping room	0	1	1
2 Cartoon girl sliding*	1	0	0	2 Cartoon girl jumping	0	0	0
3 Picture - child sliding*	1	0	0	3 Picture - child jumping	0	0	0
4 Front view paper doll*	2	1	1	4 Side view paper doll	0	0	0
5 Manikin & tube slide*	2	0	0	5 Manikin & pillow / jumps	0	0	0
6 Adult demonstration*	1	0	0	6 Adult demonstration	0	0	0

*Indicates the tasks presented to the child using the GP format.

**Indicates child's use of teaching tool in five minute free-play session immediately after all GPs were presented.

Several patterns emerged when children's spontaneous interactions with the GP teaching tools were compared. Certain teaching tools seemed more appealing or interesting to the children than others. With the exception of Ali, all children initiated play with the teaching tools during post-assessment free-play sessions and most children used the teaching tools during both post-assessment sessions. Although some children used teaching tools to simulate the motor skill taught using C&P, most appeared to use the teaching tools to revisit or recreate the motor skill taught using the GPs.

Discussion Regarding Effectiveness of Teaching Formats

All children participated in both teaching formats as part of a dynamic assessment. The intent of the single intervention session was to determine if one teaching style appeared more effective than another in teaching gross motor skills to preschool aged children with Ds. The findings of this research revealed that certain teaching methods seemed more beneficial than others. Initially the discussion will focus on the observed effects of the C&P format on

the children's psychomotor behaviours and other responses; later it will revolve around the reactions to the GPs, and why they may have been more effective.

Most of the parents simply used phrases like, "Go jump," "Show Paulene how you slide", and other verbal requests when asking their child to perform the baseline gross motor activties. Five children resisted some aspect of these parent petitions. Later, during the C&P tasks, when the parents were absent, several children appeared to refuse to move until help was offered. For example, before beginning each trial, Lisa needed to be lifted into a standing position for jumping, and Ali, Carol, and Sue seemed to need or want physical assistance for each sliding trial.

Verbal requests or prompts, followed by an opportunity for practice, are teaching strategies still suggested by individuals when teaching gross motor skills to children (Graham, Holt-Hale, Parker, 1992; Kirchner, 1992; Kirchner & Fishburne, 1998; Mosston & Ashworth, 1994). Therefore, the fact that some of the children in this research project showed positive gains in competence after participating in the C&P teaching style does not seem unusual, for this teaching style corresponds to programs that are used on young children with Ds (Block, 1991; Connolly et al., 1984; Connolly et al., 1980; Dmitriev & Oelwein, 1988; Harris, 1981; Henderson, 1985; Watkinson & Wall, 1982; Winders, 1997). In addition, the C&P teaching style follows basic principles promoted in motor learning theory which state that changes in motor performance and proficiency is often the result of practice (Fitts & Posner, 1967; Haywood, 1986; Magill, 1993; Schmidt, 1975, 1991; Shea et al., 1993; Swinnen, 1995; Wessel & Kelly, 1986; Worringham et al., 1996).

Many motor development programs for children with Ds and other developmental delays are reported to have been based on the teachings of Kephart who supports the C&P format. He, along with Chaney (1968) suggests that for children with learning difficulties, the teacher must control the tasks and child at all times, the command style of teaching is best, and the teacher must structure all the tasks and not let the child gain control of the learning activity -- until evidence shows the child is able to structure and control himself (p. 29-31). Although this teaching style would seem out dated after thirty years, Eichstaedt

and Lavay (1992) still comment on the benefits of this approach with "mentally retarded individuals" (p. 326). Generally, resources documenting how to teach children with Ds or other forms of cognitive delay, suggest they need to be taught using direct instruction, behaviour modification, reinforcement, and numerous opportunities to repeat tasks over and over (Bird & Buckley, 1994; CDSS et al., 1996; Copeland et al., 1978; Dmitriev, 1988a; Dunst, 1990; Love, 1988; Watkinson & Wall, 1982; Wessel, 1980a, 1980b; Winders, 1997).

This research discovered that the children with Ds seemed more resistant to the C&P teaching format than the GP format. According to Jobling (1996), Lovett (1996), Mervis (1990), and Berger (1990), the pattern of resistance may be the child's reaction to adult interactions with the child. Jobling reports most people claim low expressions and responsiveness by children with Ds is due to hypotonia, a physiological difficulty, while others suggest it is due to psychological difficulty. Children with Ds may be so conditioned to comply to requests with praise, that they are waiting for that motivation, or, they may be bored or unhappy with options available to them. Mervis found that mothers typically use directives and commands in their communications with their children with Ds, and this style of interaction seldom related to the child's behavior or focus of attention at the time. Mervis suggests this may result in negative responses to commands and direct instructions.

Jobling (1996) wonders if patterns of resistance are the result of too much planning and control over the lives of children with Ds. She states most activities are purposefully constructed / directed / controlled by adults, and manipulated for a lifetime. Therefore, these children may resist adult directed requests because they are tired of the lack of control over their actions. Lovett (1996), Oelwein (1995), and Beeghly et al. (1990) support this, noting when children with developmental delays are in demanding contexts, they often respond with increased passivity, avoidance, and learned helplessness. Berger comments that adult intervention generally disrupts a child's activity, and adds, as professionals tell parents they are responsible for, must stimulate, and facilitate their child's development, they and the parents, may unknowingly do too much and in this way interfere with the child. Not related directly to children with Ds, Feuerstein et al. (1979) and Braun (1993) also report if adults tell children

how to do everything or restrict their ability, they may start to see the world in an episodic way. As a result, children may not attempt to produce relationships between various experiences, establish meaningful categories, organize information, develop problem solving strategies, and / or generate ideas.

Berk and Winsler (1995) suggest other ways to interact with children: respond to, elaborate on, and guide a child's behavior with demonstrations and suggestions. Others also refer to the use of mediational techniques which permit the child to construct their own understanding of various concepts and skills (Edwards et al., 1993, 1998; Feuerstein et al., 1979; 1980; Gandini, 1993, 1995, 1997b; Hendrick, 1997; Malaguzzi, 1993a, 1993b; Rankin, 1996, 1997; Vygotsky, 1978). Such interactions seemed more aligned with the GP format.

Children seemed more attentive to adult directions when using the GP format. Granted, each child did need or want adult assistance for at least one GP trial (Refer to Table 12), but in general, there seemed to be a greater willingness on the part of the children to sit, watch, listen, and then respond in positive ways to the various prompts. The children may have responded more favorably to the GPs because each one was purposely intended to facilitate an interpersonal exchange about skills they were interested in, at a region just above their level of development -- their ZPD. In addition, all the GPs were designed to incorporate verbal and visual cues with explanations about why certain aspects of movements were important. Several GPs also included physical demonstrations, however, none of the GPs utilized physical prompts. This was because the intent of the investigation was to focus on the child's self-initiated responses to the various GPs. Physical prompts generally refer to any type of direct physical assistance which is given to a learner by an adult (Auxter et al., 1993; Baine, 1996; Kelly, 1989; Sherrill, 1993; Watkinson & Wall, 1982; Wessel, 1980a, 1980b; Wessel & Kelly, 1986).

The value of using visual and verbal cues to teach motor skills to people with Ds corresponds with findings reported by many (Block,1991; Ciccihetti & Beeghly, 1990b; Elliott, 1990; Elliott et al., 1990; Elliott & Weeks, 1993; Gillham, 1983; Oelwein, 1995; Spiker, 1990; Winders, 1997). Jobling (1996) reports children with Ds respond positively to bright visual teaching tools such as "colourful characters, and pictures of the children themselves playing outdoors

and on climbing frames" (p. 233), while Gillham and Oelwein report children with Ds respond positively to simple cartoon pictures with verbal cues.

The data in Table 13 (p. 146) seems to reveal that another component, besides combining only visual and verbal cues, is also beneficial in teaching psychomotor skills and concepts to young children with Ds. Results show that viewing posters appeared to make a difference for a few children; the cartoon cards and some picture cards seemed beneficial for others; but generally, the laminated paper doll and wooden manikin seemed to make the greatest difference in the child's ability to display their understanding of certain psychomotor concepts and behaviours. And, even though many resources (Auxter et al. 1993; Cratty, 1989; Eichstaedt & Lavay, 1992; Magill, 1993; Schmidt, 1991; Sherrill, 1993; Wessel & Kelly, 1986) refer to the use of human demonstration to facilitate gross motor skill acquisition, what was discovered in this research, is that the various manipulative teaching tools may have been more effective in facilitating a focused study of what the body needed to do during motor action, than watching a human model perform the task!

The child's interest in, and the value of using gestural or physically manipulated prompts also corresponds to more recent literature which documents best practices in teaching individuals with mental disabilities (Auxter et al., 1993; Baine, 1996; Cratty, 1989; Eichstaedt & Lavay, 1992; Robinson, Patton, Polloway, & Sargent, 1989; Sherrill, 1993). In discussing how to teach physical education to such people, Kelly (1989) writes, "Demonstrate and model the desired behaviours frequently. Use physical manipulation....Give explicit, immediate, personal, and timely feedback" (p. 256). Winnick (1990); Seaman and de Pauw (1988), and Wessel (1980b) all support this in principle, but Wessel offers more concrete suggestions. She writes that when teaching children with developmental delays to jump or slide, one should manipulate or guide the student through the skill using physical prompts. She describes various ways to do this such as

> tapping, applying pressure to the student or some other physical prompting at one or more points in the skill performance....[For jumping], stand infront of the student, holding his / her hands. Instruct the student to bend his / her knees and jump....[For sliding], hold the student as you place him / her on the slide (on back, stomach, or knees). Guide the student part way down

> the slide. Then release your grip and allow the student to complete sliding unassisted" (pp. not indicated).

She also writes that it is "appropriate to model, point out a peer who is performing the skill, or use gestures to act out the skill...give specific verbal instructions, a cue of action [such as] 'Run and jump, run fast, jump and land...Ready, set, go!'" (p. not indicated). Her suggestions also correspond to instructions given in Watkinson and Wall's (1982) PREP curriculum for young children with Ds. They write that teacher assistance may include visual and verbal cues or any form of physical prompts.

However, the difference between the strategies just described and the ones used in this research, is that the focus of most "physical education" teaching strategies refer to the physical elements of the task -- how the various body parts need to be positioned or coordinated, and what the various limbs need to do during motor action. The GPs developed for this investigation attempted to incorporate cognitive aspects of the motor skill with the physical components. So, not only were various aspects of the target task described, additional information about why those elements of performance were important was also explained (i. e. When sliding, place your legs against the sides of the slide and your hands on the edge of the slide. This way you can grasp the edge of the slide with your hands, or push outwards with your legs. This action will help you slow down if you are sliding too quickly.). In addition, the children in this research were not told or instructed what to do with their bodies during the GPs. Physical prompts in which the teacher tapped, guided, led, or maneuvered their body through various movement patterns were not used as part of the GP methodology. Rather, information about the various motor tasks was simply presented, and each child was then free to apply the information as desired. This was done to determine if the child was able to construct their own understanding of the information given to them. Data collected from the seven children seems to suggest that this was an effective teaching strategy. It appeared that the children were able to apply information presented this way, and that they made sense of it without being told how to. This type of teaching strategy was not found in the literature for children with Ds, however, it seems to

incorporate many of the strategies suggested by Baine (1996).

Baine (1996) outlines numerous instructional methods that are suitable when working with people with moderate to severe disabilities. He refers to and gives detailed descriptions of "response prompting" which includes any single application or combination of verbal prompts, leading, gestural prompts, modelling prompts, physical prompts, and pictorial prompts. However, he also writes that when choosing instructional methods, one should choose efficient, effective and simple strategies that are least intrusive, positive, unstigmatizing, chronologicaly age-appropriate, and congruent with future instructional methods. This research attempted to determine which exact teaching strategies were most effective, or able to "produce the desired changes" (p. 137) for each child when acquiring gross motor skills. This research confirmed that various combinations of visual, verbal, pictorial, and gestural / kinesthetic cues, along with explanations of why certain aspects of a motor skill were important, were beneficial in teaching gross motor skills to preschool aged children with Ds. Physical prompts cannot be commented on, since they were not used in this research.

However, based on the data gathered throughout the research period, it appears that some GPs were more effective than others. The question that remains is why were they effective? Following is a discussion on the philosophy underlying the GPs, and speculative conclusions about why the children responded more positively to them than the C&P teaching strategies.

Effectiveness of the Graduated Prompt Teaching Format and Tools

The GP format was a purposeful application of the socio-constructivist approach in education. It was used to determine if children were able to construct some meaning from information presented and then respond in ways that showed an understanding of that material. Many individuals comment that the socio-constructivist approach is better suited to the needs of children than a teaching style in which adults tell children exactly what to do, and then wait for a response (Abramson et al., 1995; Berk & Winsler, 1995; Edwards et al., 1993; Gandini, 1993, 1995, 1997a; Hendrick, 1997a; Holt, 1995; Malaguzzi, 1993a; Rankin, 1997; Vygotsky, 1956, 1978). Chaille and Silvern (1996) comment that

constructivists do not like to simply give children materials to manipulate because little understanding arises without interest, experimentation, and purposeful cooperative interactions with others.

The GP format was designed to utilize verbal, visual, and physical cues, and to have an adult serve as a facilitator / partner, working in collaboration with each child on topics based on the child's interests and experiences. Pre-assessment data showed each child was interested in sliding and jumping activities; the teaching format used simply provided multiple representations of sliding and jumping skills in various media forms. Interactions with each child were fostered through a close social context and meaningful dialogue, and children were free to express and perform what they learned in various realms.

The data in Table 12 (p. 145), which showed the responsiveness of the children to the GP format supports the literature. Berger (1990) comments that children with Ds seem to be happier and enjoy learning when tasks occur within their developmental range and in a context of rewarding interactions. Hart et al. (1987) report Vygotsky believed favorable social relationships underlie all higher functioning, because dyads think, remember, and attend in strategic ways -- one member may wonder about something, the other responds; one does the thinking for the task, and one constructs the knowledge required. Just as the relationship between a mother and child influences thinking, memory and intrapsychological functioning (Hart et al., p. 253), so too, other purposeful interactions help a child construct understanding of and meaning about various events and situations. Children may attend, listen, respond, and learn more efficiently when interpersonal exchanges occur through intervention formats that recognize and treat children as competent learners (Braun, 1993; Edwards et al., 1993; Feuerstein et al., 1979; Gandini, 1993, 1995, 1997a; Hendrick, 1997; Malaguzzi, 1993a). Writing about young children with Ds, Serafica (1990) adds, "the greatest personal growth occurs in an environment where positive interpersonal relations enhance a child's intrinsic social feelings and make him or her comfortable" (p. 369). This seems to correspond with research findings that children with Ds were more willing to engage in tasks that facilitated more positive interpersonal interactions.

The children may have engaged more willingly in the GP format because

of the types of teaching tools used. Eisner (1982) suggests that teachers need to present information in numerous ways, because humans have "a need to receive and convey information in forms that capitalize on the use of different sensory systems" (p. 74).

The first three GPs which incorporated visual and verbal prompts appeared effective for some of the children, and this corresponds to previous findings in the literature reviewed earlier. However, the data in Table 13 (p. 148) reveals that the children engaged more frequently with the paper dolls and wooden models during free-play sessions, and Table 11 (p. 139) shows that parents also reported spontaneous play with dolls away from the research setting. For the most part, this type of gross motor play with dolls had not been observed prior to the research period by any of the parents. Why may these teaching tools have been so interesting and effective?

The paper and wooden dolls provided each child with several benefits. For example, it permitted the child with an opportunity to observe the action of a human form in slow motion. Demonstrations by humans, as is normally done when teaching physical education related concepts, often occurs very fast, or it looks very unnatural if done in slow motion. The child with Ds may not see or understand what aspects of the skill they are to focus on, until the motor action is already completed. The use of dolls and other such models permits children to observe what positions their limbs need to be in during movement, what postures to adopt, and exactly how the motion is carried out. In addition, the use of paper dolls and manikins as teaching tools, permitted each child to manipulate objects. This opportunity may have provided kinesthetic perceptions about the task, and thereby helped each child to comprehend the spatial configurations and other physical aspects typically involved in performing motor skills. This enabled the child to get a clearer idea or understanding of what exact movements needed to be done before having to do it with their bodies. It was as if the manipulative objects helped to facilitate declarative knowledge before the child utilized procedural knowledge.

Some individuals comment that manipulatives are effective teaching tools; others note that handling three dimensional models facilitates spatial representation, and others write that models, dolls, and other manipulative objects

provide children with new ways to display skills and concepts they may be unable or unwilling to perform (Block, 1991; Cratty, 1967; Gonzalez-Mena & Widmeyer Eyer, 1980; Guthrie, 1994; Schwartz & Heller Miller, 1996; Mosston & Ashworth, 1994; Sherrill, 1993).

Opportunity to handle and play with the three dimensional objects also seemed beneficial to the children with Ds who participated in this research project. Based on the data gathered during each case study, all the children displayed some knowledge of sliding and / or jumping related action(s) by maneuvering the various models and dolls in comparable movement patterns. Were gains in spatial representations of sliding and jumping a direct result of handling the various teaching tools? Did the opportunity to handle the three dimensional objects develop a heightened awareness and ability to display their knowledge of various gross motor tasks? Rink, French, and Tjeerdsma (1996) believe so. They state that the opportunity to handle objects and models helps learners facilitate tactical information about concepts. Furthermore, they add that such a "hands on approach" better suits constructivist philosophy.

Lindsay (1972) also supports the need for children to experience movement related concepts through models and manipulative objects. She reports that the opportunity for direct contact with materials, models, and unorthodox tools facilitates the child's experience and direct sensations of movement. She suggests that this helps a child "form a kinesthetic image from the sequence of movements" (p. 47). Each child may have acquired a kinesthetic image, memory, or similar cognitive representation of movement, after being exposed to the various manipulative teaching tools.

Wertsch and Tulviste (1992) write that Vygotsky recognized tools and signs as the means with which one could mediate knowledge structures and thereby facilitate the learning and development of intellectual functioning. If certain "psychological, or cultural tools fundamentally transform...functioning" (p. 551) in the cognitive domain, then it follows that interpersonal interactions related more specifically to the psychomotor domain may also alter functioning in that domain. So, the opportunity to construct new cognitive connections and representations of movement related concepts, may have been accomplished by displaying and scaffolding information about psychomotor processes using

appropriately descriptive teaching tools and signs. This is supported by Tarr (1992) and Holt (1995). Tarr comments, "Modelling interactions with materials... is another way that adults engage children or create meaning for children.... [This] assists children to attain a more advanced level of development" (p. 168-9). Holt (1995) states that when someone shows another what to do, in a way the person can understand and believe, behaviours can change at once. Therefore, when one knows how motor skills are produced, one may be able to perform them at a higher level of ability. Holt cites Dr. Feldenkrais, a physio-therapist, who found when he made students aware of "what they have been doing with their muscles, and what they might do instead, they can in a very short time change the supposed habits of a lifetime" (p. 110-111). It seems that by providing opportunities for each child to manipulate the various teaching tools, they were somehow able to create an understanding of the concepts involved in motor skill performance, and this conscious awareness may have influenced the resulting motor action.

The proposed explanation for the value of the GP teaching tools in learning gross motor skills is also supported by Gonzalez-Mena and Widmeyer Eyer (1980) who comment that children solve motor problems using mental operations. "After enough experience using his sense perceptions and his muscles, [the child] can begin to think of ways of acting and try them out in his head before putting them into action" (p. 111). In the same way, children involved in this study may have "reviewed" the cognitive representation of what to do with their body before performing the skills physically.

The references cited above support the research finding that assisted instruction seems to result in a deeper understanding and meaning of psycho-motor concepts and performance. The data collected throughout this study seems to indicate that children found manipulative objects useful for acquiring knowledge about psychomotor concepts. It may be that the teaching tools facilitated the construction and development of cognitive representations of movement scenarios; then when needed, these mental operations and processes could be utilized to solve motor tasks or objectives.

One other important finding of this research was that several children with

Ds showed a self-initiated interest in performing gross motor skills, or playing in new ways that resembled motor skill concepts taught using the GP format. These research findings seem to contradict other literature. For example, Brown and Campione (1986) and Eichstaedt and Lavay (1992) write that many children with mild mental retardation can perform tasks perfectly after training when told to do so, but unless reminded, these children will not spontaneously utilize strategies previously learned. They report this is due to inflexible access, an inability to operate flexibly and fluidly in one's own knowledge base. Jansma and French (1994) add, "Never assume that incidental learning will occur with [children with mental retardation]" (p. 125), everything they acquire must be taught. French and Nevett (1993) also write that

> under the age of seven, children often do not use a rehearsal strategy unless they are cued to do so. Near seven years of age, children begin to rehearse spontaneously and their ability to mediate cognitive and motor performance increases with age. Intervention with younger children to force them to use adult-like rehearsal strategies increases the accuracy of children's movements but the variability remains larger than for adults. (p. 256)

The findings of this research indicates that all seven children spontaneously became involved in play and gross motor activity related to the motor skills taught. This occurred without any prompting or instruction from others, and they seemed to use cognitive strategies and ideas previously presented to them even though they were not, as Eichstaedt and Lavay (1992) report, cued or forced to do this. The self-initiated play and gross motor activity may have even served as a type of rehearsal strategy for each child (Rankin, 1996). If so, a cognitive representation / kinesthetic memory of the motor skills being rehearsed may have been constructed through the use of the GP teaching tools.

By scaffolding information and concepts about a motor skill using mediational techniques, it seems as if each child may have been able to construct their own cognitive understanding or representation of the motor skill, and then perform or display this knowledge in ways they were comfortable with. This supports Rink, French, and Tjeerdsma (1996) who comment that constructivism is a way students can learn motor skills. They state that constructivism facilitates the child's active role in learning. By describing important concepts and relationships between concepts, learners are permitted to construct their own

cognitive maps for the information acquired; this tends to make content more meaningful and useful. Rink, French, and Tjeerdsma add that once learners discover principles and concepts for themselves, they are in a better position to make concepts transferable to other situations.

A transfer of motor skills and concepts was observed in several situations throughout this research, and again challenges Brown and Campione's (1986) and Eichstaedt and Lavay's (1992) view that children with mild mental retardation cannot perform various tasks unless instructed to do so. Carol (Table 11 on page 137), Lisa, Sue, and John (all in Table 13 on page 146), seemed to transfer skills and concepts acquired using the GP format, and apply these principles to the motor skill taught using the C&P format. All of this was done spontaneously; it was almost as if they needed to try to make sense of the other motor skill on their own! In an article about play behaviours of children with Ds, Jobling (1996) also alludes to the ability of children with moderate to severe intellectual disability, to be able to transfer and apply information related to one item and use it later on in new ways. However, she did not indicate if this was a self-initiated response.

This research also showed that children with Ds were able to retain and use motor skill knowledge and concepts which was presented using cognitive forms of intervention. This corresponds with McPherson (1993) who writes that knowledge or cognitive representations may influence procedural knowledge of motor skills. She adds that although novices retrieve and use a simpler network of declarative knowledge as part of their method for solving motor problems, linkages between cognitive representations and procedural knowledge results in a high demand on working memory and good motor problem solving ability. Findings of this research project suggests that by purposefully influencing cognitive knowledge or representations of motor skills, children may have gained a greater understanding of and prospective ability to perform psycho-motor behaviours. But does this inference fit with motor learning theories?

The importance of influencing cognitive processes during psychomotor learning is also supported by Fitts and Posner (1967) and Cratty (1967, 1973b, 1975, 1989). Cratty believes some processes may help a child construct their understanding of movement related concepts better than others. For example,

he believes perception and mental rehearsal are essential components of learning movement tasks. Mental practice, mental rehearsal, or imaging, are considered very important aspects of learning in the psychomotor domain (Hall, Buckolz, & Fishburne, 1992; Kirchner & Fishburne, 1998; Kerr, 1982; Miller & Sullivan, 1982; Schmidt, 1991; Spaeth Arnold, 1981). Mental practice is defined as "the cognitive rehearsal of a physical skill in the absence of overt physical movements" (Magill, 1993, p. 382). Traditionally, teachers and / or coaches direct subjects to exercise either visual or kinesthetic movement imagery, and use an internal or external focus while learning or perfecting motor skills. The children in this research project were not asked to use these processes while learning or perfecting their motor skills. They seemed to perform some type of mental rehearsal on their own.

Hall et al. (1992) report that children can use and experience both forms of movement imagery, but "physically awkward children experience tremendous difficulty in both visual and kinesthetic imagery for movement" (p. 25). This seems to contradict findings of this research project. The preschoolers with Ds did exhibit some physically awkward movements as a result of their delayed psychomotor development, but appeared to use imagery as a cognitive strategy when processing psychomotor concepts. Based on the children's spontaneous play behaviours and activities, during which time they seemed to recreate, revisit, or rehearse the motor skills taught, it appeared that the GP teaching tools may have stimulated visual or kinesthetic imagery, which in turn helped the children learn concepts related to the targeted motor skill! But how?

One possibility may be that the teaching tools used in this research project facilitated visual and kinesthetic images together. Hall et al. (1992) reports that when compared to people in a control group, people who utilize "imagery" display an increased "amount and intensity of voluntary physical practice of the task" (p. 25). In this research, there were numerous instances which suggest that the preschoolers with Ds were voluntarily practicing psychomotor skills they were acquiring. For example, the parents and researcher noted increases in the frequency and ability of sliding and jumping behaviours during the free-play sessions and spontaneous use of toys at the research site and at home.

Perhaps the most interesting finding of all, is that the children with Ds were

not informed to initiate mental rehearsal or imagery to assist motor skill acquisition, yet information presented to them seemed to have been internalized. Based on their spontaneous responses over the research period, it seems as if the children were able to create their own cognitive representations of what was shown, construct an understanding of the motor skill, and then freely express this knowledge. Magill (1993) suggests this may be due to "accessible memory representation in long-term memory" (p. 385).

No literature was found which describes exactly how to help learners with Ds focus on the cognitive aspects of motor tasks. However, Vygotsky's (1978) belief that interpersonal exchanges faciliate cognitive learning and development may apply to psychomotor tasks as well. His theory proposes that focused attention is gained when a more competent person purposefully shows, describes, and explains concepts of a certain skill or event to a learner -- through mediational learning. Meaningful interactions facilitate the scaffolding of information from one to another, and this encourages thinking, processing, and comprehension of the information presented. It seems that the construction of knowledge about psychomotor concepts may have been faciliated by providing diverse forms of instruction to the child during the interpersonal exchanges of information. If so, findings of this research project seem to suggest that the socio-constructivist approach to teaching motor skills results in modifiablity of the psychomotor domain.

More Discoveries

Additional results, not included as initial research questions, also emerged from the cross case analysis. These are presented and findings will be compared to information gleaned from the literature.

Contributions from Parents

Because parents were an important aspect of this research, their contributions need to be highlighted. Parents answered questions about their child's motor behaviours before, during, and after the research period. Several patterns of parental responses were similar across various cases.

How Parents Taught Gross Motor Skills

During the initial interview, parents were asked how they taught gross motor skills to their children. The next day, parents were observed interacting with their children while asking them to perform baseline skills. Some parents displayed behaviours that were consistent with their self reports, while others showed substantial differences between what they said and how they engaged their son or daughter in gross motor activities.

For example, during the interview, one parent said she normally took her child to a particular object (i. e. a tricycle) and then used physical guidance until the child wanted to perform the skill independently. Another parent said she encouraged her child to "get the rhythm" of the movement, or learn by imitation. One mother said she never taught gross motor skills to her child at all. For the most part, parents said when teaching gross motor skills to their children with Ds, they used verbal directions, demonstrated the skill, and / or told their child with Ds to watch siblings and then to do what they did. Parents also said that they provided lots of opportunity for practice.

When parents were observed interacting with their children, numerous actions and directives were different than reported. Although some parents were observed giving verbal instructions and using demonstrations to encourage skill production, many lifted and placed their children directly into positions required for the physical activity. Parents frequently used physical guidance and support to help their children perform the motor skills; some made up / down motions and / or said words related to the activity such as, "Jump, jump". Other parents removed toys and similar items from their child, as they assumed such objects would be distracting. Several parents initiated little games, play strategies, and other prompts to gain their child's interest in the motor skill, while others used phrases such as, "Show me how to jump / slide", or "Come on. Show mom." One parent even bribed her child with food to get him to perform the baseline motor skill.

These types of interaction patterns seem to correspond closely with information presented earlier by Berger (1990), Koop (1990), and Spiker (1990) who write, that generally, mothers of children with Ds are very or overly directive in their interactions with their children and they sometimes use bribes and

threats. Spiker (1990) adds that while such mother-child interactions occur frequently, children are often unresponsive. These findings are also supported by others (Beeghly et al., 1990; Bird & Buckley, 1994; Sandall, 1988). This research shows that there are other effective ways to interact and teach a child with Ds. Mediational activities, the use of various dolls and models, verbal, visual, gestural / kinesthetic, and pictorial cues, along with physical demonstrations and explanations which provide the cognitive descriptions and reasons involved in performing a task a certain way, all appear to be more effective than using verbal directives alone.

Parent's Ideas of Other Ways to Teach Gross Motor Skills

As part of the initial interview, each parent was asked if they thought any other techniques for teaching gross motor skills to their children would work. Six parents said they had no ideas, but when pressed, four responded that using a doll may work. Another said looking at pictures in a book may help to teach gross motor skills to their child. These responses may not indicate their independent thoughts, since, as part of providing informed consent for the research project, most parents had already been told what teaching tools and strategies would be used with their child.

Generally, parents of children with Ds seek out new resources and ideas to help them teach their children (Ups & Downs, 1994-1999). However, the parent's dependency on orthodox teaching formats may be the direct result of sharing information, hearing about, or reading resources which use traditional ideas and techniques specific to the teaching of children with Ds. Books, manuals, and conference speakers suggest the following general teaching strategies: make eye contact to establish child's attention, use "cue words" which require specific responses, keep routines fairly consistent, maintain a high level of interaction and feedback, use commands and a single task approach, allow much opportunity for repetition, speak clearly and reduce extraneous noise, limit cognitive demands by presenting simple understandable content and information, use behaviour management strategies, maximize sensory stimulation, break skills into small subtasks, and use modelling, demonstrations, and physical guidance (Bird & Buckley, 1994; Block, 1994; Casto, 1988; CDSS

Conference, 1997; de Graaf, 1995; Dmitriev & Oelwein, 1988; Dunst, 1990; Effective Teaching Strategies for Successful Inclusion, 1994, 1995, 1996; Eichstaedt & Lavay, 1992; Graham et al., 1992; Kelso & Price, 1988; Sherrill, 1993; Watkinson & Wall, 1982; Wessel, 1980a, 1980b; Winders, 1997).

Findings of this project suggest that socio-constructivist practices may also be useful when teaching children with Ds. All seven preschoolers in this study seemed to benefit in some way from the GP format. This teaching format was designed to present important information in an indirect way which permitted the child to construct their own understanding of concepts. Without being instructed to do so, children with Ds appeared able and willing to use this cognitive approach to motor learning and development, and apply concepts and skills gained in new and different ways. Results of this research also seem to indicate that the children rehearsed and applied self-constructed cognitive representations or kinesthetic images of the various motor skills. It appeared that the children acquired these cognitive representation or images through the kinesthetic manipulation of objects.

Parental Expectations of Children's Behaviours

Only two of the seven parents had been to the indoor playground with their child with Ds before the research began. Pam had come approximately 15 times over a four year period, but her parents always joined her in the equipment. Pam's mother reported

> *She wants to go on the playground, but she doesn't want to go on her own, so we have to go with her....Normally when we come to this playground, one of us [parents] will go with her through the tunnels and the slides and stuff.*

John had been to the research site about 150 times. However, his parents said he had just started in the big play area. Prior to that, he spent all his time in the baby / toddler area. John's parents said they always joined him in the playground equipment, and that John actually expected this companionship.

> *Usually he waits for us to go with him, or to tell him, or to help him up there... Usually David* (John's father) *and I* (John's mother) *go into that area with him, as soon as they see an adult with him, the kids they all leave - so I*

guess it is automatic. Like David says,We will just walk in there, and they will all go." So we end up being alone. So we don't know what kind of interaction he has with other kids, cuz, they are all gone!

In general, it seemed as if all parents were apprehensive about letting their child play independently in the playground. Ali's mother summed it up, saying

I think that I am really over protective over her compared to my son who is two years younger. I probably wouldn't even worry at the age of two of him going up there, as much as I worry about the age of four, her going up there. I would not have let her go on the big equipment if I was here with another group of people. (P: How would you decide when it was okay to let her go on her own?) Maybe when her brother was three and big enough to go, or at least so he was big enough to talk, then he could help her and take care of her. (P: So were you surprised how she managed up there?) Yup. She surprised me!

During the initial interview at home, several parents described their child's gross motor behaviour as much more proficient than what was observed during the preassessment session. These parents never commented on their child's "lower abilities" or "uncharacteristic behaviours" while watching them move on the various pieces of playground equipment. As a matter of fact, it became obvious that parents felt a sense of joy and surprise regarding their child's competency of independent movement abilities at the research site during the research period. Although numerous comments were made by each parent, single examples of each parent's response are listed below.

- *"I didn't know if she'd get to that second level! That amazed me!"*
- *"I was surprised that she could actually do that. It did take her a few tries, but she was able to do that."*
- *"I didn't think she would make it that far. I didn't think she would make it all over."*
- *"You should see all the stuff she has done! She tried everything!"*
- *"I was surprised that he went up that slide on his own....Ya, ya, I am so surprised that he is going up and doing it on his own....He didn't get scared? He did not leave? Wow!...I am really impressed with my little boy!"*
- *"Wow, he's up there already!"*

- *"I am surprised that she lasted this long. I thought she'd quit along time ago."*

Although Bredekamp (1993) challenges educators to reclaim the image of the competent child, the challenge should be the same for parents and others working with children with Ds. Bredekamp comments that if people view a particular child as needy, adults typically provide minimal levels of service and intervention. However, if the child is viewed as competent, then the child is viewed as someone who has a right to high quality care and education! Snell (1987) also supports the need for all people with handicaps to have appropriate education.

Parents of children with disabilities know their child better than any other person. They recognize their children have unique learning needs, may know more about a subject matter than another individual can assess, and may express their knowledge and understanding in ways other than the traditional words and mathematical symbols (Berk & Winsler, 1995; Breig-Allen, & Ullrich Dillon, 1997; Eisner, 1982; Jobling, 1996; Kaminsky, 1998; & Kopp, 1990). However, on occassion it is a pleasant surprise to help parents recognize that their child knows more or has a greater ability than previously thought!

One other interesting pattern was discovered as a result of mapping out the child's free-play gross motor behaviours at the playground.

Patterns of Spontaneous Free-play

Each child displayed similar patterns of physical activity during the free-play sessions at the indoor playground. The three minute time notations on each child's floor plan / map revealed highly concentrated efforts in certain locations of the playground for each sixty minute session. It seemed common for most children with Ds to spend about six to nine minutes in certain locations. Some children spent from18 to 51 minutes in specific locations, but this was not consecutive time for all children. These "blocks" of time seemed to satisfy the child's desire or need to focus on one area or motor skill without interruption.

It was also interesting to note that over the course of the three different free-play sessions, each child moved from areas of highly concentrated effort to a

new location. Once there, they seemed to spend time and effort in this new area. So, from the documentation on the floor plan / maps of each child, one was able to distinguish areas children had seemingly "explored" thoroughly, and which areas seemed to perk a new interest.

No information was found in the literature about children's free-play gross motor movement patterns through playground equipment. The only literature that may relate to these findings comes from Magill (1993), Fitts and Posner (1967), and LeBlanc and Dickson (1996). Magill writes more difficult motor tasks generally take more time to perform; while Fitts and Posner suggest that human motor performance appears to be optimal between not enough stimulation or challenge, and too much (p. 33). Fitts and Posner's comment seems in line with LeBlanc and Dickson who view time spent in a specific location as an indicator of the child's interest in the motor skill. They write, "Young children are more concerned with mastering their own environment and developing skills than with beating others..." (p. 5), and enjoyment of physical activity falls within a range of tasks that are too easy or difficult. If a child perceives that a motor task is overwhelming or too challenging, they "may become anxious and not want to play anymore" (p. 11). On the other hand, if a child is forced to repeat skills over and over, or pressured to become proficient, a child may become bored and eventually drop out of the physical activity. Young children typically monitor their own ability to go on to the next stage of a motor skill, and children will not normally push themselves to the point of over-exertion. Findings of this research project tends to support LeBlanc and Dickson's comments about the time, effort, and motivation behind children's engagement in gross motor free-play. The children in this study never seemed bored or ready to quit when permitted to engage in free-play. However, they tended to oppose the repetition of directed skills. This was evidenced in their responses to the C&P teaching style (Table 12 on p. 145).

Based on the patterns of physical activity which were documented on the floor plan / map, it is difficult to know whether children with Ds spent more time in one location on the playground than another because they found the level of difficulty of the motor task appropriately challenging, or because they were simply unmotivated to go elsewhere. It seemed that children may have enjoyed

staying in one spot so they could practice and rehearse specifc skills for a time period, for eventually, children tended to explore and search for a new spot in which to play. According to LeBlanc and Dickson (1996), the child may have felt the motor skill was becoming too easy, and therefore, moved on to a new challenge. Nevertheless, this finding shows children with Ds are able to monitor their own movements through the playground equipment, and therefore, they do not need adults or others directing them where, when, and how to play.

Summary

This chapter presented findings of a cross case analysis of seven children with Ds who participated in two different teaching styles as a way to determine whether the psychomotor domain was modifiable. Main findings were that all children exhibited changes in free-play sliding and jumping related behaviours after the intervention / dynamic assessment session, and the GPs appeared to be a more effective teaching format than C&P.

Changes in sliding and jumping related behaviours included gains in frequency and / or competency. Some of the gains were evidenced in the motor skills which were taught using C&P, while others were made in the motor skills taught using the GP format. Parents observed their children performing many new sliding and jumping related behaviours at home -- their activities seemed to be direct outcomes of the child's participation in the GP teaching format.

This research revealed that the GP format was a beneficial way to assess a child's psychomotor development and ability. It also permitted one to determine which teaching techniques and strategies were effective. Of the six GPs employed within the study, the children seemed to be most responsive to interventions which employed verbal, visual, and gestural / kinesthetic cues, along with descriptions aimed to facilitate cognitive understanding of the motor tasks. The two most preferred GPs included a paper doll of each child and a wooden manikin. These two GP teaching tools permitted children to observe physical demonstrations conducted in a slow and controlled manner, as well as the opportunity to manipulate the objects. In addition, children seemed more cooperative and willing to engage in the GP teaching format than the C&P teaching format.

Additional trends revealed as a result of this research showed that parents tended to use verbal directives and physical support or guidance when interacting with their children. Parents also expressed surprise at their child's ability to move and explore the large playground area independently. Distinct patterns of gross motor activity were also noted during the one hour free-play sessions.

One of the surprising findings of this research was that children with Ds seemed able to construct cognitive representations of the motor skills presented to them. They appeared to recreate or revisit psychomotor concepts throughout the research period, and did this spontaneously. It looked like some children even used concepts gained with the GP teaching tools -- which were related to one motor skill, and then independently transfered this information to the motor skill taught with C&P.

CHAPTER SIX
OTHER WAYS ONE COULD HAVE CONDUCTED THIS STUDY

Introduction

Many aspects of this research could have been strengthened if additional pre-testing had been conducted, if assessment instruments were more precise, and if more objectivity was employed. This section details those concerns as well as other limitations of the investigation.

Clarification

This research was modelled as a dynamic assessment of the psychomotor abilities of children with Ds. This meant that the researcher was interested in the child's unassisted performance of psychomotor skills, but also in their ability to perform a task with some form of assistance (Hoy & Gregg, 1994). These are considered "qualitative" variables. The key question was: What instructional strategies and teaching tools would it take to assist the child to make gains (Samuels, 1997)? The time frame for this project was purposely short; similar to the length of time school psychologists have when they meet a child and / or their parents, conduct initial observations, perform assessments, and then provide recommendations about effective intervention methods (Mowder, 1996). This was to establish if such techniques could be clinically practical.

This investigation was also exploratory, as dynamic assessments have not been previously conducted within the psychomotor domain (Burton & Miller, 1998; Hoy & Gregg, 1994). The research was not planned as a scientific experiment. Extensive pre- and post-tests were not conducted; norm-referenced, standard forms of assessment, and other screening devices which have high validity and reliability were not used. Comparisons were not made between treatment and control groups. Other aspects of scientific precision were also not included in purposeful ways. As a result, numerous elements of this study could be criticized as lacking rigor.

It was suggested that there may be alternate ways to conduct similar research in the future. What follows are suggestions if one desires to conduct a more objective, thorough, and experimental version of the same topic.

Additional Pre-Assessments

Numerous pre-assessment procedures were undertaken with individual children. Each child was observed: (1) during a one-hour free-play session, (2) while the parent encouraged their child to slide down a small slide and jump on a trampoline, (3) during the dynamic assessment tasks, and (4) by parents at home throughout the research period. Short-falls related to these pre-assessments were recognized at the conclusion of this research.

Conducting the Free-play Pre-Assessment Period

> The best way to learn about development and function [of an individual's physical ability] is to observe persons in...environments....[such as] a room or outdoor area full of apparatus and play equipment....For children and youth,...there should be ladders and ropes to climb, ramps or slides for moving up and down, bars to hang and swing from, balance beams and interesting surfaces to navigate, tunnels, and a variety of movement challenges like swinging bridges, structures that rock, and walls made of tires or heavy cargo nets.....This kind of setting allows observation of whether or not persons know how to play, like to play, or have the language and motor skills to play. Most persons, given this environment will demonstrate the full repertoire of their locomotor movement patterns. They will run, jump, leap, hop, climb, swing, roll, slide, and the like. (Sherrill, 1993, p. 111).

Since a location with this exact make-up was unavailable, the assessment of children's free-play behaviour was conducted at a large age-appropriate indoor playground. As part of the research design, one pre-assessment period was conducted on site before the child participated in the intervention / dynamic assessment session. It was felt that this observation would give the researcher a fair indication of the child's level of independent gross motor activity and competence. Since parents were present for this assessment, it was assumed that they would "speak up" if their child's motor behaviours were uncharacteristic of their actual ability. However, not one of the parents commented about their child's atypical motor activity during the one hour pre-assessment.

In a book on the special educator's role in assessment, Hoy and Gregg (1994) write, "Assessment activities must be quick, focused, and easy to interpret" (p. 7). While the single sixty minute period for pre-assessment was

similar to the time frame that Wessel (1980a, 1980b), Folio and Fewell (1983), Linder (1993), and Watkinson and Wall (1982) recommend for assessing the gross motor abilities of pre-school aged children with or without special needs, others suggested that more frequent pre-assessment efforts would be valuable.

This advice is justifiable since children with Ds display extreme variations in their ability (Connolly et al., 1980; Cunningham, 1988; Dyer et al, 1990; Hodapp & Zigler, 1990; Kopp, 1990; Spiker, 1990) and as a result, their performance in various tasks, such as motor skill activity, can change from day to day. Baine (1996) writes, "Because of the characteristic performance variability observed among individuals with severe disabilities, short-term, one-time, clinical testing may produce invalid and unreliable test results" (p. 4). By observing the children several different times, the effects of motivation; general health; sensory deficits; acclimatizing to new people, tasks, locations, and / or equipment; and other individual factors may become evident (Eichstaedt & Lavay, 1992; Sherrill, 1993). Such information may result in a better understanding of children's behaviours on a particular day. Therefore, it may have been more beneficial to conduct two or three pre-assessment free-play sessions to assess the child's baseline gross motor ability, rather than a single episode.

Challenges with Parental Involvement During the Pre-Assessment Session

Parents were asked to have their child display typical sliding and jumping abilities on specific pieces of equipment as part of the initial pre-assessment. This was done to establish a baseline measure of the child's functional gross motor proficiency, and to observe how the parents interacted with and taught their child gross motor skills. However, when people know they are being watched as part of a special project, their behaviours may change. This is referred to as the "Hawthorne effect" (Psychology Licensure Exam Review, (PLER), 1997a). As a result, the parent's behaviours at the research site may not have been characteristic of the types of teaching methods typically employed at home and / or away from the scrutiny of observers. Had the parents conducted the same activity with their child, without knowing the researcher was observing them, findings about parent teaching styles may have been different (Burton & Miller, 1998). In hindsight, this aspect of the pre-assessment may

have been altered to consider such factors.

Use of Different Equipment in Pre-Assessment

Each child was asked to perform baseline sliding and jumping behaviours while under the supervision of their parents, in the "intervention room". The equipment used for this was of much smaller scale and size than the play-ground equipment that the children moved on during the free-play sessions. This was done for numerous reasons outlined in the methods section. However, it may have been a more useful measure of initial gross motor ability, to have used one particular slide and the trampoline in the large play area for all pre-assessment measures -- rather than using the child's observed performance on the smaller equipment as a way to judge their presumed ability on the large equipment. The challenges associated with this idea were: the tunnel slides made it almost impossible to observe (and video) the child in sliding motion from top to bottom, few parents were willing or able to follow their child through the various elements of the playground, it was tiring and difficult to get to certain locations on the playground, and, in the event that the sliding or jumping related activity was not clearly observed (or videoed), the child would need to work their way back up and into the proper gross motor position again. This travel through the playground could take up to five minutes. In addition, the playground was a public play area, and although permission was granted to use it as a research site, it seemed disrespectful to the other patrons to monopolize one location for an extended period of time for numerous days -- just so the researcher could obtain the data required for the study.

Furthermore, as suggested by Dunn (1997), the researcher was curious if the children would use psychomotor concepts taught during the dynamic assessment in a "distraction free area" such as the intervention room, and apply them in other locations. So, although people may question the decisions made in this aspect of the research, different sets of equipment were used in the pre-assessment for the reasons cited above.

Issues Related to Use of 'Cognitive Tasks' used During the Intervention Period

During the intervention / dynamic assessment session, five tasks (described

in Appendix 5) were conducted with each child at the conclusion of each gross motor teaching session. This was done to assess whether the child had a cognitive understanding of the motor task they just participated in. Tasks for this dynamic assessment of the psychomotor domain were developed by the researcher and parents of children with Ds involved in the pilot study, and were formed following suggestions given by Ulrich and Collier (1990) and Dunn (1997). They suggest using bright, colorful, and / or black and white pictures to assess aspects of physical competence in children with mental retardation. In addition, the dynamic assessment tasks were modelled after items included in tests such as the BSID II (Bayley, 1993). The BSID II, an eclectic assessment device with content derived from many other scales (Bayley), measures mental and motor ability in young children as well as other traits.

The BSID II (Bayley 1993) utilizes many props during a full assessment. Several adaptations of these props were used in this research. For example, the BSID uses colored and black and white pictures, colored cartoon-type pictures, and a small doll with matching props to assess cognitive ability in children, starting as young as 11 months of age. The "mental" test items assess: memory, attending to visual / auditory stimuli, habituation, problem solving, naming, pointing, pattern concepts, generalization, classification, vocalization, and language and social skills. On the other hand, the BSID "motor" scale test items assess the control of gross and fine movements, and are "not concerned with functions generally perceived as 'mental' or included in the intelligence scales" (p. 1). Considering the types of "psychomotor" concepts the researcher was interested in assessing, wanting to combine "mental and motor" operations, taking the advice of parents into consideration, and being purposeful about using verbal and visual information together -- in order to accommodate findings that children with Ds respond positively to such educational tools and strategies (Block, 1991; Cicchetti & Beeghly, 1990a; De Graaf, 1995; Dunn, 1997; Dunst, 1990; Elliott, 1990; Spiker, 1990), the following tasks were used in this research project. Tasks included: drawing two pictures (one of someone sliding and one of someone jumping); looking at pictures and identifying which children were / were not sliding down a slide or jumping; placing four cartoon cards in a proper movement sequence; and, demonstrating sliding and jumping

actions with a wooden manikin and other related props. These tasks required pointing or naming, identifying action represented in pictures and cartoons, attending to relevant aspects of pictures and cartoon drawings, verbal comprehension, visual discrimination within and between pictures, sorting, playing appropriately with dolls, and other similar abilities.

Black and white cartoon pictures; colored photographs; and two different dolls were used in some of the dynamic assessment tasks because others have used similar visuals and props when working with children with Ds or developmental delays (Cowden & Torrey, 1990). For example, when the BSID II was administered to 60 children with Ds, they were required to attend to, comprehend, and then respond to similar assessment cues and props. In addition, Oelwein (1995) and Gillham (1983) work almost exclusively with black and white cartoon-type pictures when teaching children with Ds to read. Oelwein, who has worked since 1971 with the researchers at the Program for Children with Down Syndrome and Other developmental Delays in the Model Preschool Center at the Experimental Education Unit, Child Developmental and Mental Retardation Center, Univeristy of Washington, has produced an excellent resource with many examples of cartoon characters in action scenarios. Numerous cartoons show motion lines related to physical activity. Oelwein reported that the original "techniques developed were expanded and adapted for use in various educational settings and for all age groups" (p. iii). Therefore, it was assumed that due to the scope and field testing of the BSID II and Oelwein's teaching programs, similar cartoon-type pictures, photographs, and dolls could be used in this research.

While concerns may be raised about the ability of children with Ds to understand adult directions and then manipulate dolls to display physical activity, sort pictures, recognize motion depicted by cartoon characters, attend to the proper details in pictures, and other picture literacy concerns, parents assured the researcher that their children were quite capable of these tasks (Personal communications with other annonymous parents, 1999-2000). In addition, all of the children in the pilot study and this research responded in ways which illustrated their understanding of some of the tasks during the dynamic assessment. It seemed that the older the child, the more they

seemed to comprehend. As a matter of fact, one child, the oldest in the study, answered all the dynamic assessment tasks properly -- indicating that the level of difficulty of the tasks was within the preschooler's range of ability.

Nevertheless, in a more rigorous investigation, pre-tests of the various dynamic assessment tasks could be conducted with the children. These pre-tests would provide baseline measures of each child's comprehension, picture literacy ability, and proficiency in manipulating dolls in ways which display specific physical activities.

Parent Observation and Journaling of Children's Motor Behaviours

Collaborative efforts are generally more effective than one person conducting an assessment on a child (Bricker & Widerstrom, 1996). Parents are a valuable part of assessments since they know their children better than any practitioner or specialist, and as a result, parents are able to determine if their child can understand and / or knows various concepts (Berk & Winsler, 1995; Breig-Allen, & Ullrich Dillon, 1997; Eisner, 1982; Jobling, 1996; Kaminsky, 1998; & Kopp, 1990). In addition, parents can provide a "perspective of the student's functional levels in an environment other than school" (Hoy & Gregg, 1994, p. 19). Therefore, throughout the research period, parents were invited to observe their child with Ds at home and journal their sliding and jumping related behaviours.

Some may question whether parents are valid and reliable observer's of their children's behaviour. Changes in pre and post-treatment behaviours may only be "perceived gains", the result of increased parental vigilance, or a desire to see and report improvements to researchers who voluntarily work with their children. This may be the case. However, qualitative research as employed in this investigation, cannot impose standards of honesty and accuracy on other people's reports. As mentioned in the researcher's paradigm, people deserve to be treated with honor, dignity, and respect.

If repeating this research in the future, one may ask parents to document their child's sliding and jumping related behaviours for approximately one week before the initial free-play session at the indoor playground. This would provide additional information about the child's pre-intervention gross motor

competence. Additional sources of information, such as video recording the child during play, may also have been utilized to gather data on the child's psychomotor behaviours at home. Yet, the similarity of the descriptions of the children's changed psychomotor behaviours across cases provides some validity to parent reports.

Using Objective and More Precise Assessment Methods

The goal of this research project was to determine if "qualitative" differences existed in the gross motor performance of preschoolers with Ds after they participated in a single intervention session. Since a mature version (Graham et al., 1992) of each target skill was documented, this could be judged with a criterion-referenced test. Of the hundreds of motor tests available (Burton & Miller, 1998), many were considered. These included: the BSID II (Bayley, 1993), the Bruininks-Oseretsky (Bruinink, 1978), the PDMS, (Folio & Fewell, 1983), the Denver II (Frankenburg, Dodds, & Archer, 1990), the Pediatric Evaluation of Disability Inventory (Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992), the Transdisciplinary Play Based Assessment (Linder, 1993), the Revised Test of Motor Impairment (Stott, Moyes, & Henderson, 1986), the Test of Gross Motor Development (Ulrich, 1985), the PREP Play Program (Watkinson & Wall, 1982), and the I CAN - Preprimary Version (Wessel, 1980a).

Even though most of the tests were able to claim validity and / or reliability, each was lacking in other ways. For the most part, descriptions and measurements of sliding and / or jumping skills were either non-existent or too general; children's levels of ability or interest in the various skills was not considered, children were expected to perform the motor skill independently -- but only when directed to, age ranges were not suitable, the tests were screening devices rather than full assessments, and performances were marked with either a simple "pass" or "fail". The largest limitation was that if the child did perform poorly on a particular task, there was no information about the aspects of the skill(s) he / she was able to perform, why the child may have performed poorly, and what teaching strategies or other forms of intervention may have resulted in future improvements.

It is difficult to stray from the use of formal, standardized, norm or citerion

referenced tests, as most individuals working in, or commenting on assessment techniques, suggest the use of such tests (Bayley, 1993; Burton & Miller, 1998; Eichstaedt & Lavay, 1992; Folio & Fewell, 1983; Hoy & Gregg, 1994; PLER, 1997b; Sattler, 1992; Sherrill, 1993). However, other assessment forms may also be beneficial in this type of investigation (Burton & Miller), since assessment which involves the "processes of movement", refers to "quality, form, or experience and generally relates to whether a movement pattern is mature or immature....Checklists and pictorial instruments are [valuable] ways to encourage process evaluation. Other examples of process measures are journals, diaries, anecdotes, pictures, and film" (Sherrill, 1993, p. 157). Burton and Miller add other informal assessment forms: "interviews, inventories, observations, questionnaires, rating scales and teacher made tests" (p. 101), and describe the advantages of informal tests. "They allow for observations in more natural settings and for an examination of the environment on movement performance" (p. 101). Such was the goal of this investigation.

Future research on this topic may include a criterion referenced test such as Wessel's (1980a) The I CAN-Preprimary Program. This program is suited to the age range and ability of the children in this research. It includes a free-play assessment score sheet and target skill criterion for both jumping and sliding skills and focuses on both product and process items associated with gross motor skill acquisition. However, the I CAN-Preprimary Program does not meet all of the research questions of this study and there are numerous limitations associated with criterion referenced tests. For example, Burton and Miller (1998) report that there is no documentation on validity and reliablity for the I CAN Program (p. 343). Nevertheless, the addition of the I CAN Preprimary Program to this research would have permitted comparisons of children's performances on a criterion referenced test with the checklist which was developed for this research project. Such information would have provided another way to "accommodate an individualized approach to asssessment and intervention....indicating what individuals are able and not able to do....[and possibly supply some insight into the deficits underlying poor performance" (Burton & Miller, p. 96). In addition, a comparison of the I CAN Pre-primary Program outcomes may have served to validate the checklist made for this

research.

This research had other shortcomings. Some related to the study itself, and others related to data collection. These will be discussed.

Limitations of the Study

Because each child is unique and skill acquisition in the psychomotor domain includes cognitive, physical, and affective components, it is difficult to determine exactly what is happening in the various realms during motor learning and development. Unfortunately, current assessment tools generally focus on one domain at a time, hence losing valuable information about aspects of learning and development which occur concurrently (Rink, French, & Graham, 1996). Since the premise of this research was that cognitive processes influence the psychomotor domain, yet internal operations cannot be documented or easily measured, implications about the linkages between these domains were based entirely upon observable behaviour. It is unrealistic to claim with certainty that visual or kinesthetic imagery, or any other mental representation of psychomotor concepts was used as a tool of thought, because children were unable to express that information. Although the way in which each child directed their attention and behaviour in new realms remains a mystery one can only hypothesize about, the explanations presented are based on information blended from many disciplines which seem best able to describe the observed events.

In addition, the learning and development of motor skills includes a maturational component. Knowing this, the study was designed to encompass an eleven day period to reduce the effects of ongoing maturational differences in each child. And, since learning and development of fundamental motor skills occurs throughout the preschool years (Bayley, 1993; Decker, 1988; Sanders, 1982; Sherrill, 1993; Stinson, 1988; Wickstrom, 1983), it seemed reasonable to use this age range as a parameter for sample selection. However, the varied age range of children used in this study and the wide variation of motor skill ability within each child, made it difficult to assess exactly how differences in motor behaviour were acquired. A better strategy may have been to find more

children with Ds born in the same year and month, and then study this restricted age range more closely. However, it would be very difficult to find this type of sample in a single city because the incidence of Ds in the population is relatively small.

Some children may exhibit effective motor performances with low variability and later change to high variability with disruptions in motor performance (Starkes, 1993). This makes it difficult to establish true gains in motor learning and development, determine actual cause and effect relationships, and / or claim with certainty that specific interventions resulted in changed psychomotor behaviours, since "behaviour is a function of an interaction of events" (Barlow & Hersen, 1984, p. 45). The same problem arises when using free-play as an indicator of gains made in a particular domain. Since children do not perform motor skills consistently during free-play, differences observed may not indicate gains in psychomotor behaviours at all! Altered motor behaviours may be the result of unrelated factors such as experimental and environmental conditions, behavioural and emotional fluctuations, social and biological factors, or other unidentifiable variables. However, one may assume that these conditions challenged all of the research participants to one degree or another.

Just as children's behaviours are influenced by multiple factors, researchers are affected by numerous variables. Since interactions between the researcher and child may have been altered throughout the research period as a result of factors impinging on the adult, so too the "cognitive strategies exhibited by children during dynamic assessment might vary as a function of instruction provided" (Burns, 1985, p. 2). To maintain maximum consistency, instructions were documented with great detail (Appendix 4.2), mounted on the walls of the intervention room, and referred to frequently.

All children exhibited some changes in psychomotor concepts and behaviours after the single intervention / dynamic assessment session. However, this does not mean altered patterns will remain over time. It is difficult to forecast future effects of intervention procedures, especially when the intervention session was so short. Dynamic assessment is not designed to induce permanent change but rather to provide a window on what is possible

(Lidz, 1991).

In addition, similar patterns of change were not found for each child. When wide variability in research findings are found, and only a few children are involved in the study, it is impossible to state that one form of intervention was significantly better than another. Also, the generality of findings for larger groups of similar people cannot be established.

Limitations also existed as a result of using a multiple case study research design. Challenges included making decisions about: how to select a sample, which motor skills to study, setting time and context boundaries, the number of children to include in the study, and what instruments and measurement strategies to use. In addition, decisions needed to be made regarding which aspects of individual cases were exemplary of the topic being investigated. To reduce volumes of data per child only certain excerpts of each case were presented. Unfortunately, the depth of any single case was reduced. Although the researcher was able to recall certain behaviours observed throughout the research period and associate one with another, the reader does not have the same priviledge. Therefore details about individual cases may be missing, or unsubstantiated inferences may have been made.

Finally, the researcher's background, experience, interests, and manner of documentation may have resulted in skewed, biased, or altered descriptions, and as a result, a lack of objectivity, precision, and rigor (Barlow & Hersen, 1984; Creswell, 1998; Feagin, Orum, & Sjorberg, 1982; Yin, 1994). For example, the researcher had a personal interest in using certain teaching formats and interacting with the children and their parents in specific ways. These strategies were shaped by a desire to show that there may be new and different ways to interact with and teach children with Ds. In addition, the data collected reflected the researcher's interests and biases. To reduce this source of bias, four parents proofread descriptions of the case notes documenting their child's participation in the study and other strategies were utilized.

Challenges Associated with Data Collection

Other limitations within the research project were related to data collection. For example, choices had to be made about how to gather information from the

research participants. In using a case study research design, it is important to gather enough information from multiple sources so a rich and colorful description of each case could be constructed. The methods used to collect data were developed and tried during a pilot study and found suitable, therefore the data was collected in the same way for all participants in this research project.

Time and financial support for the research also created limitations. A professional photographer had been approached, since one goal was to produce a video dissertation showing pre and post research motor skill activities. This became too costly, and written dissertations remain the preferred form of documentation. Therefore, to reduce costs, amateur research assistants were hired to assist in data collection. This resulted in other problems. For example, the video camera person did not capture all aspects of the research and occasionally the operator focused on motor skills the researcher did not want or need to record. The video tapes only provided a narrow view of the child's activity within the environment; it was not possible to ascertain if children were prompted from a distance by others. Capturing the children's spontaneous verbal responses was also difficult; the speech was often quiet and the research location was full of noise and rambunctious activity, which made it very difficult to discern the exact content of each child's utterances.

Information is lost when researchers convert utterances, movements, and other behaviours produced in the cognitive and physical realm, filter and interpret it in subjective ways, and then change the experience into written text. In addition, when writing information on the floor plan / map, one could only look down for a moment -- otherwise other important data may have been missed. It was difficult to document information quickly and in such a way that data was legible and descriptive enough for the research needs. There was an underlying sense that children might initiate another important motor related activity that would be missed if long times were spent writing down information.

Certain precursors of sliding and jumping were noted and established early in data collection, but other aspects of the targeted motor skills were inadvertently omitted. For example spontaneous kicking behaviours may have also been pertinent to the development of jumping, yet these were not recorded.

This research project utilized a very short intervention period. Most children with Ds are involved in programs for months and years at a time. This "tiny slice" of time simply showed what may be possible using new forms of intervention. More or less noticable differences may become evident over a longer period of time.

As in any study, additional sources of information may have provided important details. Parents could have been asked about their child's perceived energy, attitude, and emotional state before each research session. Two or three pre-assessment free-play sessions may have been documented, since it was impossible to know if patterns of free-play behaviours changed after the intervention, or as a result of simply having the opportunity to engage in free-play. In addition, it would be interesting to know what children would have done with the various intervention tools before the researcher used them purposefully with the child in the GPs. It is impossible to know how differently they played with the teaching tools after the intervention because there was no measure of their behaviour with the teaching prompts before that session.

As the research progressed, it became apparent that all teaching tools should have been placed on a low platform or on the floor so children could access them during the five minute free-play session after each intervention format. This had not been planned. Several children came to the "intervention table" seemingly looking for the teaching tools during the five minute time period, but only one child helped herself to a prop and used an item in play (Lisa in Table 13, p. 146). In addition, the wooden manikin should have had a simple face drawn on it. Children often looked at the"front and back" of the wooden head, seemingly trying to orient directionality. The lack of facial features seemed to cause some confusion, since many times the manikin "faced" the wrong way for certain motor skill displays (i. e. the manikin often descended slides with the "face" upside down).

Finally, there was no way of knowing how other children with Ds, not participating in the intervention session, would have played at the research site during the same time period, for a control group was not in place for the study. If a control group was used, one may have observed changes regardless of intervention procedures, and final conclusions may have been much different.

Summary

The intent of this research project was to focus on "qualitative" changes in behaviour and comprehension related to the psychomotor domain, that children with Ds displayed after participating in a dynamic assessment / intervention session. Therefore, qualitative measures were used in this investigation. Unfortunately, qualitative research designs are frequently criticized for their lack of objectivity, precision, and rigor (Barlow & Hersen, 1984; Creswell, 1998; Feagin, Orum, & Sjorberg, 1982; Yin, 1994). This chapter focused on various procedures one could have added and / or changed inorder to reduce challenge s to the validity and reliability of the data.

In addition, numerous shortcomings were recognized while conducting the research. These included theoretical issues and practical concerns. Complications involved throughout the data collection were also highlighted.

CHAPTER SEVEN
FINAL COMMENTS

Introduction

Two main findings arose throughout the study. One was that current theories of motor learning and control are unable to explain the children's changed psychomotor behaviours, and the other finding was that the GP format appeared more beneficial than the C&P format for helping preschoolers with Ds acquire gross motor skills or generalize concepts related to the psychomotor domain. The findings generated as a result of this research stimulated many new questions about psychomotor learning and development in preschool aged children with Ds. This chapter presents implications of the study, areas for future research, and a conclusion of the findings.

Implications of the Study

The single and brief application of the GP format, appeared to advance certain elements of the psychomotor domain for each child involved in the study. Although the C&P format also seemed to provide gains for some, the benefits of this teaching style cannot be claimed for all seven children. This is a key finding and has direct implications for future use with children with Ds.

When planning programs of gross motor skill acquisition for children with Ds, practitioners should consider using the types of teaching strategies and tools that were employed in this research. For example, teachers would be encouraged to consider using verbal, visual, and gestural / kinesthetic prompts, along with physical demonstrations -- which are displayed with dolls and other manipulative models. In addition, instructions should include detailed explanations about the various aspects of the targeted motor skill and why certain behaviours are important in the learning of the task. Practitioners currently working with other children with delayed motor development or movement disorders, could also be challenged to utilize similar procedures. Although a single application of such practices were used via the GP format, this cognitive-educational approach appears to result in gains in the psychomotor domain. Others have already commented that using a constructivist approach in motor learning and development is a very valuable area of research (Hall et al., 1992; Magill, 1993;

Rink, French, & Graham, 1996; Shea et al, 1993).

Findings of this research should also be presented to parents of children with Ds and those who assess gross motor skill development. Give them information about the benefits of mediational teaching. Allow them to view various teaching props. Offer concrete examples of how to apply the instructional strategies and prompts. Then, together come up with new methods with which to address other movement related challenges. Explore other aspects of human learning and development that could be impacted using similar approaches. Finally, encourage them to use their plans. As parents and assessors begin to see the value of using different intervention and asessment approaches, they may begin to utilize more effective strategies rather than relying primarily on the commonly utilized C&P teaching format and / or standardized assessment tools.

Future Research Options

This research found that the various theories and approaches currently adopted in the motor learning field were unable to explain some changes in the psychomotor behaviours of children with Ds. However, Vygotsky's socio-historical theory of cognitive development seemed to be able to account for the findings. This application of Vygotsky's propositions to the psychomotor domain is worth investigating further. This also confirms the viewpoint of many who claim that motor learning theories must be revisited -- to accommodate more interdisciplinary perspectives and because the present explanations are incomplete, disconnected, and do not match practical applications (Abernathy & Sparrow, 1992; Abernathy et al., 1993; Cratty, 1973b; Kelso, 1982; Keogh, 1977; Keogh & Sugden, 1985; Magill, 1993; McPherson, 1993; Reid, 1990; Schmidt & Fitzpatrick, 1996; Seefeldt & Haubenstricker, 1982; Whiting et al., 1992; Wickstrom, 1983; Worringham et al., 1996).

This research may also encourage new ways to conduct motor skill assessments. This is encouraged by Burton and Miller (1998). Dynamic assessment may be able to provide valuable information about the various teaching strategies that result in immediate and noticeable improvements in psychomotor behaviours. In addition, one may gain insights about a child's understanding of psychomotor concepts. Using models, dolls, and other such

teaching tools and props, children may be able to express what they know about motor skills without having to perform the skill personally (Mosston & Ashworth, 1994). This is a valuable component of motor skills assessment since declarative knowledge is equally as important as procedural knowledge when facilitating or measuring learning and development in the psychomotor domain (Baba, 1993; French & Nevett, 1993; Rink, 1996; Wall, 1990). Future research may determine if dynamic assessments of the psychomotor domain are effective with children of all ages, if these techniques permit one to accurately measure the cognitive components of motor skill performance, and if dynamic assessments can measure physical performances and cognitive understandings simultaneously.

This research also found that the GP format appeared to create positive changes in psychomotor behaviours in children with Ds. This happened even though the children were not instructed to consciously use the teaching tools and prompts to help them remember certain aspects of the motor skills. Had the children been asked to actively focus on applying the teaching strategies or other cues in purposeful ways, and if the intervention phase was longer, would they have shown greater gains? What other findings would arise? These future research topics are based on Hall et al.'s (1992) suggestion that, "Developing better imagery abilities in physically awkward children may be one way to improve their motor behaviour that has not yet been capitalized upon" (p. 25).

Finally, this research may also encourage new ways to teach physical education to all children. Cognitive processes are an important aspect of motor skill acquisition -- even though this is seldom considered when teaching young children (Kirchner & Fishburne, 1998; Mosston & Ashworth, 1994). Because "the development of organizational strategies is similar for cognitive and motor performance tasks....[and] younger children's performance can be enhanced by imposing adultlike organization strategies" (French & Nevett, 1993, p. 256). Teachers of physical education and coaches should encourage learners to use cognitive strategies and processes while learning and performing gross motor skills. For example, the use of mental practice, imagery, or any other psychologically based representational forms may enhance gains in the psychomotor domain (Cratty, 1989; Hall et al., 1992; Magill, 1993; Rink, French,

& Tjeerdsma, 1996). If applied with young children, and shown to be successful, such metacognitive strategies may result in "profound changes in the methods of instruction, course content, and, indeed, the perceived importance of physical education in the school curriculum" (Hall et al., 1992, p. 25).

Summary and Conclusion

Psychomotor learning and development is a complex process which involves many factors. The elements focused on within this study included cognitive processes and motor ability, because these have been highlighted as critical components of motor skill acquisition by individuals and theorists working in the motor learning area.

The main goal of this research was to determine whether the psychomotor domain was modifiable. This was investigated by observing psychomotor behaviours before and after a dynamic assessment / intervention session. After establishing a baseline measure of gross motor ability, seven preschool aged children with Ds participated in an intervention session which included the use of two different teaching styles to teach two different gross motor skills. One teaching style incorporated a C&P teaching format and the other a GP format. The C&P format focused on the physical elements of the motor task, while the GP format included a mediational form of instruction which focused on influencing the cognitive understandings of motor behaviours. The C&P teaching style follows accepted theory and current practices in the field of motor learning, while the GP teaching style is based on principles and beliefs of Lev Vygotsky's (1978) socio-historical theory of cognitive development. A case study research design was used to examine this topic.

The intervention / dynamic assessment session involved six C&P trials and six different prompting techniques. Immediately after the intervention session, children participated in several tasks which were designed to assess the child's declarative knowledge of the motor skills. Children were also invited to participate in free-play activities at a large indoor playground one day and one week after the intervention. The free-play sessions permitted each child to exhibit procedural knowledge of the motor skills.

Results varied. However, data presented throughout the individual case

study samples and the cross case analysis indicated the child's knowledge and performance of motor skills were positively affected as a result of two types of intervention.

Two main findings emerged from the study; one was that current motor learning theories and approaches were unable to account for the children's changed psychomotor behaviours, while Vygotsky's theory did. In addition, this research found that the GP form of intervention appeared more beneficial than the C&P teaching style. Additional findings of this study are described in chapter summaries.

Findings relevant to the original research questions are as follows:

1) Children displayed differences in the ways they performed sliding and jumping related activities after they participated in the intervention session.

2) Differences in frequency and competency of gross motor skill behaviours were observed at the large playground during free-play, and parents observed new and different motor related behaviours at home.

3) The GP form of intervention appeared to influence learning and development of psychomotor skills more than the C&P teaching format. All changed and / or new psychomotor behaviours that children displayed, seemed more closely related to the motor skill that was taught using the GP format than the skill taught with the C&P format. For the most part, parents also observed new and different motor related behaviours at home which seemed closely aligned to the GP teaching style. The teaching strategies and tools used within the GP included visual, verbal, and gestural / kinesthetic prompts, as well as physical demonstrations that were displayed with dolls and models. In addition, information aimed to influence the cognitive understanding of the various motor skills were explained using a mediational teaching approach.

4) Children's knowledge of motor skills seemed to be affected as a result of the various types of interventions. They voluntarily used the teaching tools and strategies from the GP method to revisit, rehearse, or display their knowledge of the two different motor skills. They also seemed to show new ways of thinking about the motor skills taught using the GP format; three children appeared to use concepts acquired with the GP teaching format, and spontaneously apply these to the motor skill taught with the C&P format. Of interest is that all seven

children were more receptive to the GP teaching format during the intervention session than the C&P format.

5) The cognitive form of intervention did appear to effect the psychomotor domain in positive ways. Each child displayed new gross motor behaviours or ways to express their knowledge about motor skills after participating in the GP teaching format. Therefore, to address the main research question, one can infer that the cognitive form of intervention did modify the psychomotor domain in preschool aged children with Ds.

Discussion about why the cognitive form of intervention seemed more beneficial than the C&P format is included. The perspective taken, is that rather than simply responding to a task by doing the required motor skill, the purposeful influencing of the child's thought processes may have helped each child construct their own meaning and cognitive understanding about the motor skill. A cognitive representation or visual / kinesthetic memory may have been stimulated and acquired by scaffolding presentations of the verbal, visual, and kinesthetic cues during the GP intervention. Mental rehearsal, imagery, or some other movement monitoring strategy, may have assisted the child in remembering important aspects of the motor task. While active in play or performing the motor skill at a later date, the cognitive recollection of motor skill concepts and performance seemed evident.

It appeared that the interpersonal exchanges facilitated by the teaching tools of the GP format, impressed a "movement consciousness" (i. e. a cognitive representation of a movement scenario) in the child's cognitive awareness. One could speculate that this cognitive representation becomes an integral part of learning and development in the psychomotor domain. This assumption would be worthy of further study.

Results of this research project indicate that the psychomotor domain was modifiable in preschool aged children with Ds. This finding is in line with Romanow, cited by Brandow (1995) who states, research is coming forth that "children who monitor their own movement learning, learn movement skills faster, more effectively and more efficiently" (p. 51).

Following is one more example of a "psycho" - "motor" scenario which was observed in this study.

Reflections in Action

After I explained what and why certain limb positions were important when sliding, and then showing Pam this, using the laminated paper doll of herself, Pam wanted to hold the doll. She manipulated the arms and legs properly, and mimicked the doll 'sliding' through the air on an imaginery slide several times. This play continued for a few moments. Then, as before, I asked Pam to show me sliding. She stood up, taking the paper doll with her, and walked over to the large plastic slide. With a large smile on her face, she climbed part way up the slide stairs and stood there momentarily, doll in hand. Unfortunately, the doll's left arm fell off. She saw this and seemed surprised. Pam touched and held the spot where the arm was missing using a pinching grip with her right thumb and forefinger. While I went back to the table to try to fix the elbow joint, Pam looked at the doll again, placed her own thumb on the doll's left shoulder 'joint', spread her fingers out in such a way that there was a wide distance between her left thumb and index finger, and then actually pointed at the camera person with her index finger - seeming to indicate that she had created another arm for the doll! She did this twice. While Pam was waiting for me to repair the doll's arm, she sat on the top of the slide, and straddled it with her legs.

I returned, stuck the arm back on the doll, and backed away from the slide. Pam manipulated the arms and legs of the doll downwards so the arms were closer to the sides of the body, and the legs were only slightly apart. Then she said something that sounded like, "Chip", "Dat", and made some other utterances. Eventually Pam climbed part-way back down the slide stairs, and holding the doll, said, "Go slide down. Pam go slide down." She leaned forward, resting her stomach on the top of the slide, and laid the doll down on the slide. It did not move. She pushed it slightly, and the doll came down the slide, feet first, facing upwards, just like the sliding motion of a real person!

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APPENDICES

Information Included in Appendix

Appendix 1. Invitation to Join Study

Dear Parents of Preschoolers with Down syndrome,

My name is --. I am a graduate student in the Department of Educational Psychology at the University of --, conducting a research project under the supervision of --, as part of the requirements to a Ph. D. degree. I am writing to provide information regarding my research project "Modifiability of the Psychomotor Domain" so that you can make an informed decision about participating in this study.

The title is difficult to understand - however, it simply means that by blending knowledge in kinesiology, education, and educational psychology, I will be investigating the application of an alternative approach to teaching gross motor skills to young children with Down syndrome. Specifically, I would like to teach motor skills using cognitive strategies, and see how information presented in this manner will impact the child's understanding and performance of two gross motor skills - sliding and jumping. I will be using techniques that were developed in collaboration with three other par-ents who have young children with Down syndrome during September to December 1998. Techniques used then and now will include simple forms of sliding, and jumping which will be performed on slides and trampolines in a separate room in the play area.

If you agree to participate in the study, you will be invited to: 1) answer several questions about your child's gross motor ability and how you teach motor skills to your child, 2) participate in mapping out your child's spontaneous movements in a large indoor playground, 3) ask your child to try various sliding and jumping activities, and 4) keep a journal for a period of ten days. Your child will be invited to: 1) express their knowledge and understanding of gross motor activities in new and uniquely different ways, 2) play at a large indoor play-ground for four days, 3) be video taped and photographed, and 4) participate in two forms of intervention,one aimed at acquiring sliding skills and the other aimed at learning jumping skills. Your child will be supervised closely at all times.

Typically research projects require anonymity of the participants, however, because this research is being videotaped, you and your child will be identified visually and by first names only. (Because your child is young, it may confuse him/her if I referred to them using another name.) On all other information gathered (transcripts, journal entries and other adult / child responses, and photographs) you and your child will be assigned a pseudonym. The master list which indicates the pseudonyms with the corresponding adult/child identities will be available only to me and my supervisor. This master list as well as other records and information gathered will be kept in a locked filing cabinet within the researcher's home or at the supervisor's office. Several segments of the video tapes, some of the child's productions, and some photographs may be included in the development of a professional video tape which will be used to

present findings to professional and academic groups, or as a resource about the impacts of using different forms of intervention. Nevertheless, refusing to be involved in the professional video production will not alter a family's participation in the project. You will have four weeks after data collection is complete to decide whether or not you and / or your child would like to be in the professional video. In addition, results of this project may be reported, displayed, or published. If individual examples are needed for illustrative purposes in these publications, pseudonyms will be used to ensure the privacy of you and your child. All identifying information, will be kept in strictest confidence, and will not be released without your prior knowledge and written consent. Results of this study will be available at the completion of the project, and all records will be destroyed three years after publication of the results of the study.

Participation in this study requires eleven days, however, one only needs to attend the research location for four sessions of 60 - 75 minutes each. Participation is voluntary, so you and / or your child are free to withdraw at any time without penalty. I will also discontinue your child's involvement if I feel that it is not in his / her best interest to continue to participate, and if the situation for termination arises, the reason will be conveyed to you and your child. It is believed that risk factors from participation are no greater than those experienced in daily activities.

If you have any questions, please feel free to contact: 1) me at --, 2) my supervisor --, at --, 3) the Office of the Chair, Faculty of Education Joint Ethics Review Committee at --, or 4) the Office of the Vice-President (Research) at --.

If you wish to participate in this research project, please contact me as soon as possible, and I will answer additional questions that you may have about participating in this study. After all your questions are answered to your satisfaction, I will arrange for you to have access to two copies of the consent form which you will be required to sign. One signed copy is for my records and the other copy is to be retained by you for your own records.

Thank-you very much for your cooperation; I look forward to hearing from you within the next week or two.

Sincerely,

-- (B. P.E.; B. Ed.; M. Sc., Provisional Psychologist)

Appendix 2. Consent Form For Research Participants

I / We, the undersigned, hereby give my / our consent for_____ (adult's name) and _____ (child's name) to participate in a research project entitled, "Modifiability of the Psychomotor Domain."

I / We understand that such consent means that I / we will participate in:

- answering several questions related to my / our child's gross motor ability and how I / we teach such skills,
- committing to come to -- at -- for sixty to seventy-five minutes each day for three consecutive days - Tuesday through Thursday, and then one visit seven days later,
- asking my child to slide and jump on different pieces of equipment. This will be video taped, and
- documenting and informing the researcher of any self-initiated skills that relate to sliding and jumping activities that I / we observe my / our child performing, or hear reference to, in the three day research period and in the seven days that follow.

In addition, I / we understand that our child will participate in:

- having four photographs taken of him / her in order to develop a 'laminated doll' as a teaching tool,
- physical activity at -- for sixty to seventy-five minutes each day for three consecutive days - Tuesday through Thursday, and one session seven days later,
- being photographed and being featured in video recordings, and
- spending one session participating in various teaching and assessment procedures which will look at my / our child's ability to understand, express information about, and perform skills related to sliding and jumping.

I / We understand that research activities will cover an eleven day period, but I am / we are only required to come to -- for four sessions of sixty to seventy five minutes each.

I / We understand that participation in this study may be terminated at any time by my / our request, or at the request of the investigator. Participation in this project and / or withdrawl from this project will not adversely affect me / us in any way.

I / We understand that this study will not involve any greater risks than those ordinarily occurring in daily life.

I / We understand that my / our child's first name and my / our first name will be used during video taping sessions, however, all other data will be assigned a psuedonym.

I / We also understand that all other data and identifying information will be kept in strictest confidence, and I / we understand that all raw data will be kept in a locked filing cabinet at the researcher's home, or at the supervisor's office and

destroyed two years after publication of study results. Any other identifying information will not be released without my / our prior knowledge and written consent.

I / We understand that a professional video may be made of this research project, and that I / we may be identified visually and on a first name basis. I / We understand that such a video tape will be used for sharing the results of the research project with professional and other academic groups, and for other educational purposes only.

I / We also understand that if I / we refuse to participate in the professional video production, that I / we may still participate in the study. I / We will inform you within four weeks after the data collection is completed as to our involvement or refusal to be in the professional video production.

I / We understand that findings from this research project may be discussed at presentations or in published reports. Pseudonyms will be used if individual examples are needed for purposes of illustration.

I / We have received an extra copy of this consent form for my / our own records. I / We understand that if I / we have questions I / we can contact: 1) the researcher, --, at --, 2) her supervisor --, at --, 3) the Office of the Chair, Faculty of Education Joint Ethics Review Committee at --, or 4) the Office of the Vice-President (Research) at --.

_____

_____

Date Signature of Parent / Guardian of Child

_____

Adult Participant's Printed Name

Appendix 3. Main Pre- and Post-Assessment Measures and Techniques

Parents, assigned a pseudonym, will answer the following interview questions into an audio cassette recorder. Raw data will be transcribed, and then destroyed.

3.1. Pre-Assessment Interview with Parents - at Home

- Tell me about your child's gross motor skills and abilities. Specifically, explain their experiences in sliding and jumping activities.
- Tell me the strategies that you use when teaching your child gross motor skills such as sliding and jumping? Any other techniques that you think would work - but just haven't tried?
- Do you think your child can process and express information about sliding and jumping in ways other than performing the skill or through speech? If so, how?

3.2. Pre-Assessment Interview with Parents - at Playground

- Tell me what observations you made about your child's gross motor skills and abilities. Specifically, explain their experiences in sliding and jumping activities.
- Describe the types of strategies that you used to teach (or try to teach) your child gross motor skills such as sliding and jumping.

3.3.Parent Responses on the Final Day

- Did you observe any activities and behaviors that appeared to be related to sliding and jumping activities during the research period?
- Did you find that your child could process and express information about sliding or jumping in ways other than speech and / or performing the specific gross motor activity? If so, how? What did you come to learn and understand from their productions and activities?
- Did you see any evidence that would support the efficacy of one teaching style over the other within this research period? Explain your answer.
- Do you think you know which teaching style was used for which motor skill? If so, how could you tell?

3.4. Information about Photographs taken of Child on Day One

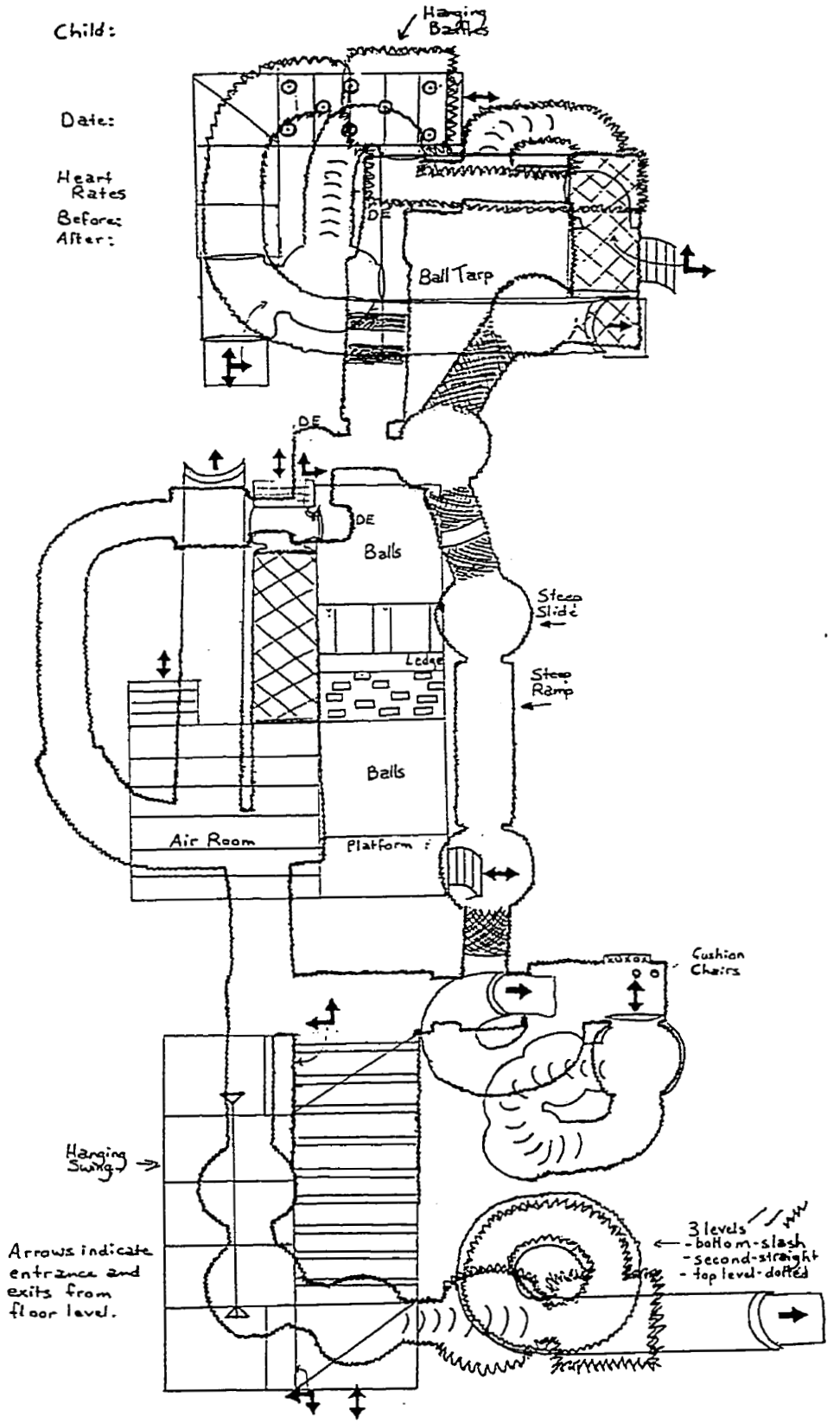
Four photographs will be taken of each child during the home visit. Individual photographs will feature a front, back, left side and right side view. These will be enlarged and altered so as to construct two 'laminated paper dolls' of each child involved in the research project, each one a dual sided view of the child, complete with moveable joints at the head, shoulders, elbows, waist, hips, and knees (See Appendix Figure 1. for the paper dolls which were developed during preliminary work from Sept to Dec 1998).

Appendix Figure 1. Laminated Paper Dolls used in Pilot Study

3.5. Physical Activity Floor Plan / Map

A floor plan / map has been developed as a way to document the child's movement patterns at --. A timer will sound every three minutes as a way to document how quickly and how far the child moves on and in the various pieces of playground equipment. The map, shown in Appendix Figure 2, will be filled out by the parent and researcher on Day Two, Day Four, and Day Eleven. The procedures are similar for pre and post-assessment records.

Appendix Figure 2. Miniature Physical Activity Floor Plan / Map



Appendix 4. Procedures and Scripts used for the Intervention Period

4.1. Instructions for Command and Practice Teaching Format

4.1. a. For Sliding

- "Please go down the slide. Put your arms out to the side, hold onto the edge of the slide, and spread your legs apart."

4.1. b. For Jumping

- "Please jump up and down. Bend your knees, lift both legs at the same time, and use your arms."

4.2. Guidelines & Scripts for Graduated Prompt Teaching Format

Procedures for sliding activities are highlighted first, and to reduce repetition, a less detailed version of the strategies used for jumping will follow.

Natural questions and interactions may occur between the child and researcher while the interventions take place, as well as during the five minute period set aside for the child to reflect, rethink, revisit, reconstruct, or practice the motor activity. To stimulate thinking about movement experiences, some of the questions and prompts used by the researcher may include slight adaptations or modifications of those presented by Bushner (1988), Mosston and Ashworth (1994), or Haywood, Brooks, and Burns, (1992) who suggest:

A. Invite responses to questions about the activities the children have performed.

B. Observe the child's responses to try to determine their thinking strategies, and offer simple feedback.

C. Use phrases which invite the child to respond by doing something creative, telling, or drawing (i.e. "show me..., try to..., find a way..., suppose you..., how else...?")

D. Invite the child to label the activities they are involved in or drawing, for this will stimulate thinking, focus attention on the details they are focusing on, and even label items for them if asked as a way to teach vocabulary.

E. Invite the child to talk outloud while problem solving and revisiting the activity, for this will help them experiment with verbal cues and rehearsal strategies.

F. Provide freedom and be willing to allow the child to display their knowledge about the activities using various tools, symbols, and other forms of media.

G. Use phrases such as: I see you can..., what is next?; I see you are..., show me more?; If you do..., what could follow, or what else could you do then?

On Day Three, parents will bring their child to a separate room at -- and then leave -- for the remainder of the session, returning only to pick their child

up after the 60 - 75 minute session[5]. This way parents will not be able to observe, or have any other indication of, which particular teaching style was used for which motor skill, and they will therefore not confound or interfere with the research project by trying to impact the child's psychomotor activities during the remainder of the day and evening.

4.2. a. For Sliding

A. To begin the thinking processes about the upcoming movement experience, each child will be shown a large poster sized picture of one of the big slides at --, and the child will be told that children like to slide down slides like this. The slide will be identified verbally, and the child is invited to move their hand along the slide in the picture. Then they will be asked to slide down the little slide.

B. The child will be shown a white laminated 12.7 cm by 17.8 cm card[6] on which is a simple two dimensional red cartoon-type character sliding down a slide, with arms and legs in proper sliding position. The picture clearly shows the character's legs and arms extended outwards with hands holding onto the edges of the slide in order to slow down the gliding motion. The body posture will be pointed out, and the rationale for going slower will be explained to the child. In addition, the child will be invited to place their finger on the extended arms and legs, and then the child will be asked to slide down the slide again. (See Appendix Figure 3 for an example of this card.)

C. The child will be shown three card pictures of real children sliding. The distinct body posture and limb positioning related to sliding will be shown, described verbally, and then the child will be invited to touch and finger the laminated cards. In addition, the child will be told that the children featured in the picture cards put their arms and legs out so that they can hold onto the slide with their hands - which will slow them down. As well, by spreading their legs and putting their feet outwards against the sides of the slide, their gliding speed will also be reduced. Thereafter, the child will be asked to slide down the slide again. (Sample photographs in Appendix Figure 4 show children sliding and jumping[7].)

D. Next the child will be given two laminated paper dolls featuring themself, which were made from the four photographs taken on Day One. The dolls will be identified and called by the child's first name, and the child will be shown that the doll is an actual representation of themself on both sides. Then the doll will be manipulated according to the specific body positions that are

[5] By meeting the child at their home previously, and by interacting with the child and parent on the previous day at --, there is an assumption that the child will be comfortable remaining with the researcher during this time period.

[6] (or five inch by seven inch). This is the same size that is used for all the other cards mentioned in this research project.

[3] Photographs are courtesy of: Little Tikes®, Canuck Trampolines, Henderson Recreation Equipment Limited, ChildSpace Playgrounds Ltd., Swing.n.Slide®, Kompan®, and All American Trampoline and Swing.

required for proper sliding posture, and the child will be reminded that people put their arms and legs outwards while sliding so that they will not go so fast when they come down the slide. Then holding the paper doll in the air, the researcher will simulate a sliding motion using phrases which includes their name such as: "Here comes child's name - down the slide," and the researcher will use sounds such as "Weee" that slowly go down in volume and octave. Once the details related to sliding posture, positioning, and motion has been explained, the child will be invited to manipulate the dolls, if they choose, and then the child will be asked to slide again. (An photograph of example dolls were shown in Appendix Figure 1.)

E. An artist's manikin (30.5 cm or 12 inches in length) and a long straight paper tube, proportional in size and cut out along the top edge, will be used in the next intervention level. These three dimensional models will be positioned in ways that replicate a person going down a slide. Again, hands, arms and legs will be carefully positioned in the proper position, and the artist's manikin will then 'glide' with the pull of gravity, down the inclined slope of the paper tube. The explanation about slower gliding motions will be given, and then the child will be invitied to manipulate these models in order to facilitate learning. The child will be asked to slide down the slide again. (Appendix Figure 5 shows the artist's manikin described above with the props for both sliding and jumping.)

F. The last level of intervention will involve the watching of and listening to a human subject. This researcher will climb up the stairs of the slide, sit at the top, and give direct information about what they do with their own body when they slide down a slide, and why they do what they do with their body (slow one's self down and not go too fast). The researcher will not tell the child what the child must do, because the goal is to see if the child can construct their own understanding of the sliding skill and carry it out independently. After the child has been asked to descend the slide one more time, the last aspect of the graduated prompt method is complete.

Once the child has completed these six levels of intervention / assessment, they will have a short time period in which they are permitted to move around, practice motor skills, become involved in other areas of the playground, or draw pictures, verbalize, manipulate or utilize and play with any of the intervention tools as they choose. The time is given in order to facilitate processes involved in rethinking, reflecting, revisiting the sliding activity, however, the child is truly free to explore elsewhere if desired, and therefore, they may not utilize the time period for this purpose. This free time period will be permitted for five minutes, and while spontaneous activity or processing is happening, the children will be observed, videotaped, photographed, and watched carefully. Once this five minute period is finished, the post test activities documented later in Appendix 5, will begin immediately.

4.2. b. For Jumping

The teaching of jumping will progress in a similar manner as the other skill.

A. To begin the cognitive processes before the movement opportunity, each child will be shown a large poster sized picture of the trampoline at --, and the researcher will simply say that this is an area where children like to jump up and down. The child will be invited to touch or rub the area on the poster where the jumping activity occurs, and then simulate jumping motions by making up and down motions with their hand. Then the child will be asked to jump on the mini trampoline.

B. The child will be shown four cards, each of which has a previously mentioned cartoon-type character of a child in a different aspect of jumping motion. (See Appendix Figure 3.)The first picture clearly shows the character simply standing on the ground. The next card features the character standing with both feet on the ground, crouched and leaning slightly forward, with knees bent, arms bent at the elbows and to the back, and the shoulder joints also bent and positioned to the back. The researcher will tell the child that this is the 'ready' position - that the boy / girl (corresponding to their gender) is getting ready to jump. The character featured on the next card displays the arms thrust upwards, the knees bent even more, and the feet still together on the surface. The character has jumped off the floor surface in the next card, in full jumping motion. This last card shows a fully extended body, with straighted legs, straightened trunk, with both feet off the surface together, and arms fully thrust upwards. All body postures and limb positions will be pointed out visually and verbally. Descriptions will be given about how and why the character starts in the ready position with knees bent, ready to use their arms, and then moves by thrusting the arms upwards, straightening the bent knees, and beginning the upwards motion of jumping. (By starting in a ready position with all limbs bent, the child is kind of stretching their muscles so that the muscles have more spring in them, like an elastic. Also by thrusting the arms upwards, the person initiates an upward movement of the body and the muscles of the legs and feet simply act as propelling forces - springing upwards too. This will be simplified for the child.) The child will be shown that both feet travel together, in an up / down motion. Then the child will be invited to finger where the character's limbs are on each card, and then the child will be asked to try jumping again.

C. The child will be shown a picture of a real child jumping. Using the same strategies and terms used when referring to the cartoon-type character cards, the researcher will point out and describe the importance of the the distinct body posture and limb positioning in jumping activities to the child. After the child has had an opportunity to hold and finger the cards, the child will be asked, "Show me how to jump on the mini trampoline".

D. Next the child will be given two laminated paper dolls of themself. The researcher will carefully manipulate these dolls into jumping postures, concentrating on the arm - leg - foot motions, and then display this motion on the table or other flat surface. In simulating the jumping motion, the paper doll

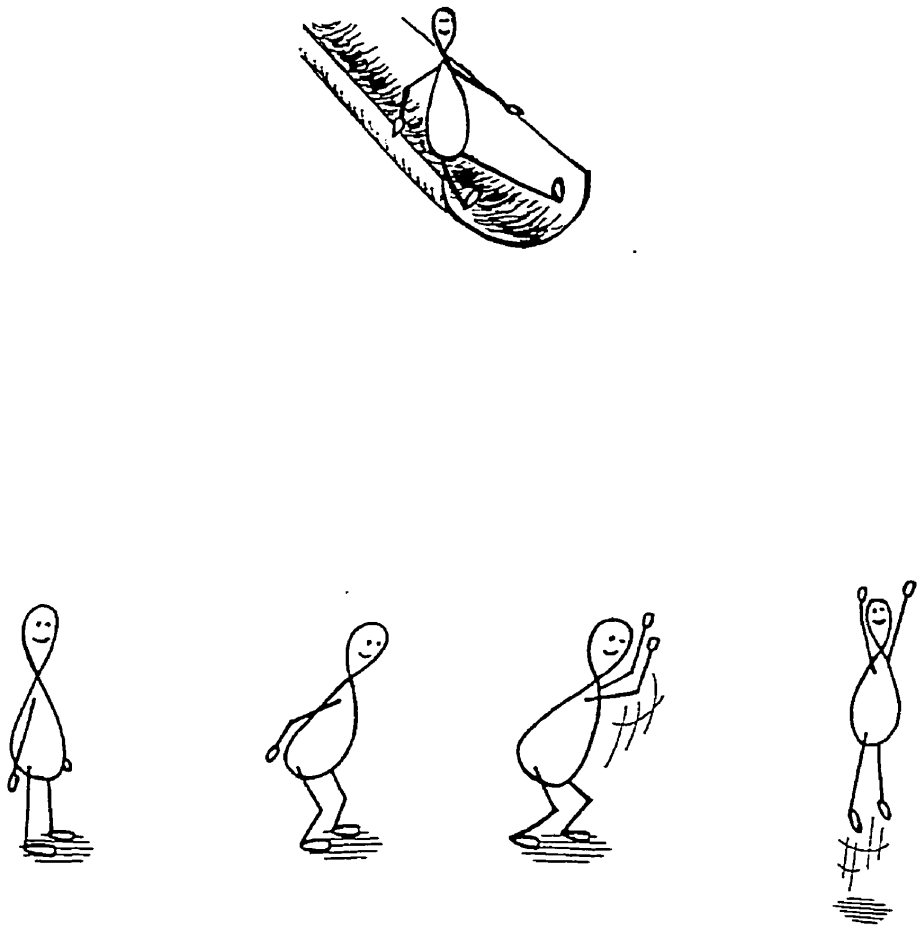
will be lifted up and down, each time focusing on lifting both feet up together, bending the knees, and using the arms. This scenario will also include simple word phrases like: "Jumping, jumping. Up and down, up and down," which will match the researcher's head movements and be rhythmic, using a louder volume and higher pitch for the word "Up", and altering the voice to be lower in tone and less in volume for the word "Down." The researcher will also use word phrases such as, "Bend the knees, bend the knees, lift both feet, lift both feet, use your arms, use your arms" in a rhythmic fashion. The child will be invited to manipulate these models as well. Once explained this way, the child will be asked to jump on the mini trampoline again.

E. The wooden artist manikin and a small pillow will be used next. These three dimensional models will be positioned in ways that replicate a person jumping up and down on a soft surface. Again, arms and legs will be carefully positioned in the proper position, and the doll will then 'jump' with the researcher's help. It is of interest to note that while the arms will need to be positioned by the researcher for this demonstration, all the joints in the artist's manikin actually work and the knees will bend and spring into bent positions when the doll is pressed down hard on a surface, and into straight positions when the doll is lifted into the air. The child will be asked to manipulate these three dimensional models as well. Then the child will be invited to jump on the mini trampoline again.

F. The last level of intervention will involve the researcher, who will step onto the mini-trampoline and then acting as the visual model, will give verbal instruction, and then act out physically what she must do with her own body when she jumps. However, they will not tell the child what the child must do. With this last element, the intervention section related to jumping is over.

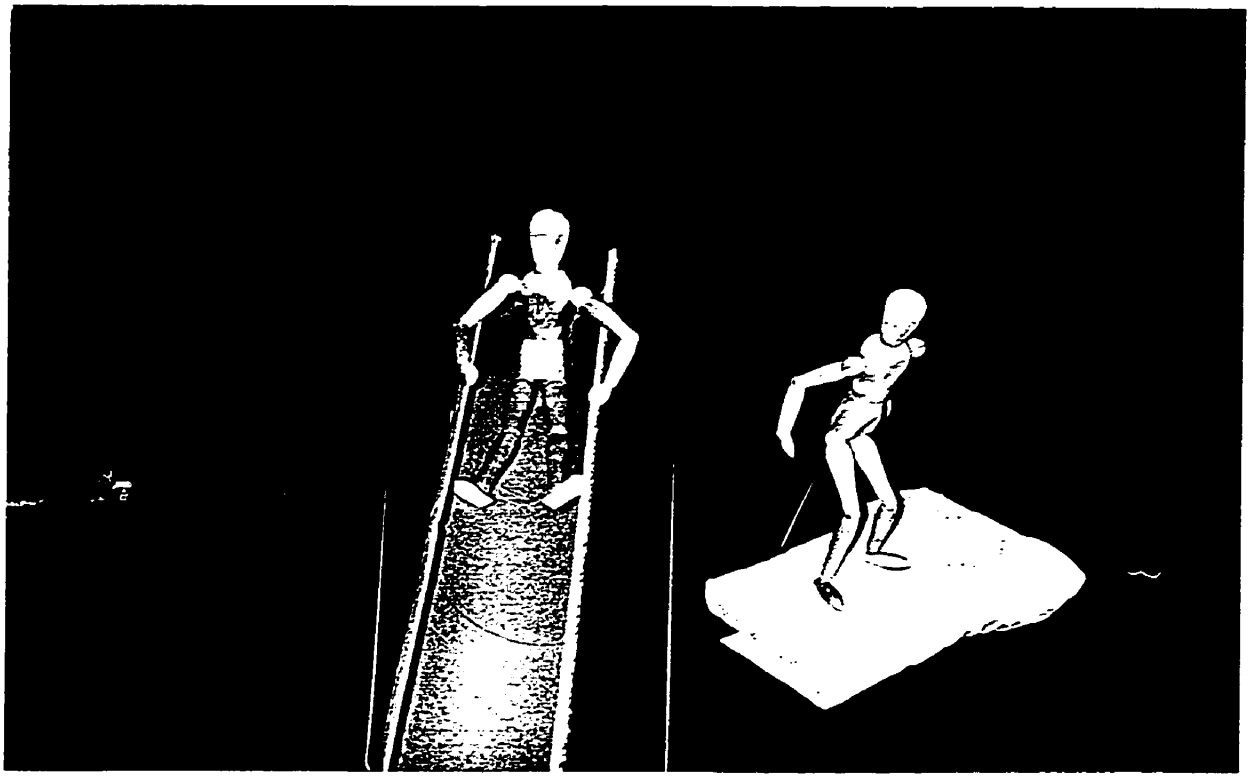
As reported earlier in the intervention / assessment procedure for sliding, once the child is finished these six steps, they will be given a free play five minutes period, followed immediately by the implementation of several post tests.

Appendix Figure 3. Sample of Cartoon-type Characters Used to Show Body, Limb Position, and Posture for Sliding and Jumping



Appendix Figure 4. Sample of Picture Card Showing Real Children Sliding and Jumping

Appendix Figure 5. Manikin and Props Used for Teaching Sliding and Jumping



Appendix 5. Descriptions of Post-Assessment Tasks

Some of the procedures listed in this section are for immediate post-assessments, and others are delayed post-assessments which occur one day and one week after the intervention period. Procedures reported previously will be maintained for: video taping, documenting the child's physical activity on the floor plan / map of --, collecting other responses from children and parents. Detailed first are the immediate post-assessment tasks.

5.1.Scripts for Post-Assessment Tasks

All activity will be videotaped in order to establish a detailed record of events.

After the child has completed the five minute spontaneous play time period, each child will be assessed using the five tasks listed below which corresponds to the motor task that they just completed. For example, each child who finished sliding using the command and practice or the graduated prompt teaching style, will begin with questions related to sliding activities. In addition, as the child responds to the following tasks, one may ask additional questions according to the suggestions presented previously by Bushner (1988), Mosston and Ashworth (1994), and Haywood et al. (1992) in order to gain a greater understanding of the child's knowledge structures and the information that they may be trying to express.

5.1. a. For Sliding

1. If the child did not choose to draw a picture of sliding, during the five minute free time period period, the researcher will simply ask, "Please draw me a picture of someone sliding down a slide." As the child constructs the picture, questions should be asked. If the child already produced a picture during the five minute free time period, the task below will be the first task initiated for the post-test.

2. The child will be invited to look at four different picture cards of real children performing various physical activities. Of these four cards, only one picture will feature a child sliding, but this child is not sliding in the exact manner in which the research participants have observed, with the traditional form of legs out, arms out, and holding on postures. The child will not have seen this card before. Out of these four cards, the child will be asked to find the picture of the person who is sliding. "Show me which child is sliding. How do you know?"

3. A series of four faceless cartoon characters performing different aspects of sliding will be featured on cards. The researcher will show the first card to the child and say while pointing at a small red cartoon character, "See, this person is standing on the ground, and she / he (matching the gender of the child) wants to go sliding. Please show me the right order using these other pictures." Meanwhile, the researcher places three other cards, face up on the table, in a mixed up fashion. The researcher then says, "When you are finished putting the pictures in the right order, the pictures should make a story about someone sliding down a slide." (The following order is considered correct. #1. The cartoon character is ascending the steps on the back of the slide. #2. The cartoon character is part way down the slide, with arms and legs extended outward in proper sliding position, and holding on to the edge of the slide with hands. #3. The cartoon character is at the bottom of the slide, and bending forward as if preparing to get off). The child will be asked, "Tell me about the story," and "How did you decide that that was the right order?" (See sample pictures at end of this Appendix for four card series of sliding and jumping.)

4. The child will be shown four cards of real children performing various motor skills. None of these will have been used for the teaching cards or other post-assessment tasks. Three of the pictures will feature children sliding, and one card will show a picture of a child performing another gross motor activity. The child will be asked to listen very carefully and determine, "Which person is NOT sliding?" After the child points or tells the answer, the child will be asked to explain why they chose their answer by the question, "How do you know?".

5. The child will be given the artist's manikin and the long paper slide tube. Referring to the artist's manikin as a 'doll', the child will be asked, "Show me how you would help this doll to slide."

In the event that the child continues to maintain an interest in the various activities related to sliding for extended periods of time, the child would continue to be videotaped until the end of the seventy-five minute session - unless they had yet to begin the other teaching intervention for jumping.

5.1. b. For Jumping

After the five minute free play period, each child will be assessed in the following way for cognitive processes that relate to jumping skills. Questions asked during this section are simply altered to reflect a focus on jumping.

1. If the child did not choose to draw a picture of someone jumping, the researcher will simply ask, "Please draw me a picture of someone jumping." Ask questions. If the child already drew a picture of jumping, have the child start with the task below.

2. The child will be invited to look at four picture cards of children performing various physical activities, however, there will only be one picture of a child jumping - but one that they would not have seen before. This jumping picture will be quite different than the others - this one features a teenager jumping with legs spread outwards in a 'gymnastics splits formation'. Out of these four, the child will be asked, "Show me the picture of the child who is jumping. How do you know?" Ask other questions.

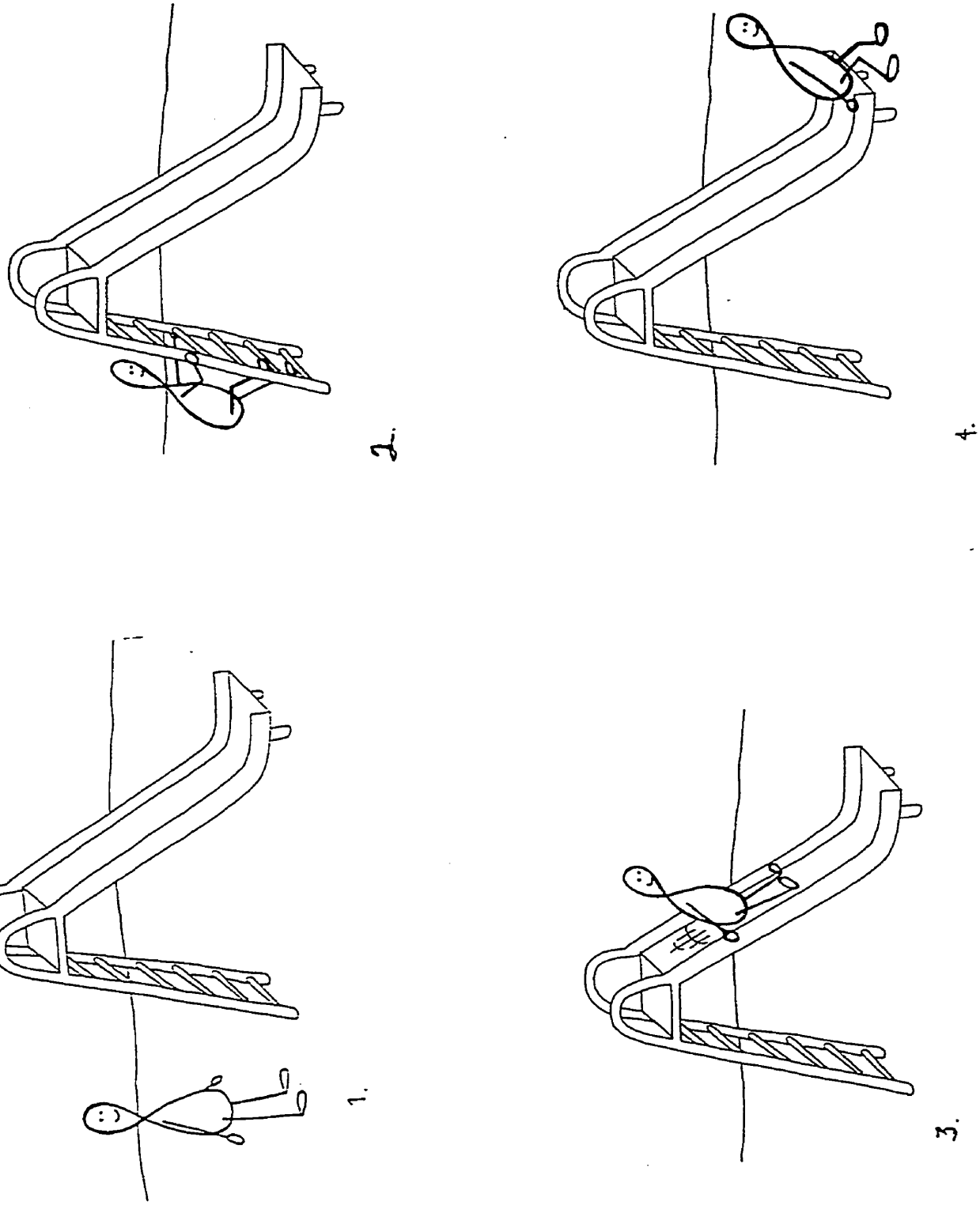
3. A four card series of cartoon characters will be featured next. Each card depicits a different aspect of jumping on a trampoline. To initiate this task, the researcher will show the child the first card, which features a red cartoon character standing on the ground beside a trampoline. While pointing at the cartoon character on the first card, the researcher will say, "See this person standing on the ground. She / he (matching the gender of the child) wants to go jumping on the trampoline." During this time, the researcher presents the other cards, face up, but in a mixed up fashion, on a flat surface or on the table infront of the child. The researcher continues, "Please show me the right order using these other pictures. When you are done, the pictures should make a story about someone jumping up and down on the trampoline." (The following order is considered correct. #1. The cartoon character is climbing up onto the edge of the trampoline surface. #2. The cartoon character is preparing to start jumping, and is in the ready position. #3. The cartoon character is fully extended in a jumping motion.) Ask questions.

4. The child will be shown four picture cards of real children performing various motor skills. Three of the pictures will feature children jumping, and one card will show a picture of a child performing another gross motor activity. The child will be asked, "Which person is NOT jumping?" Ask questions.

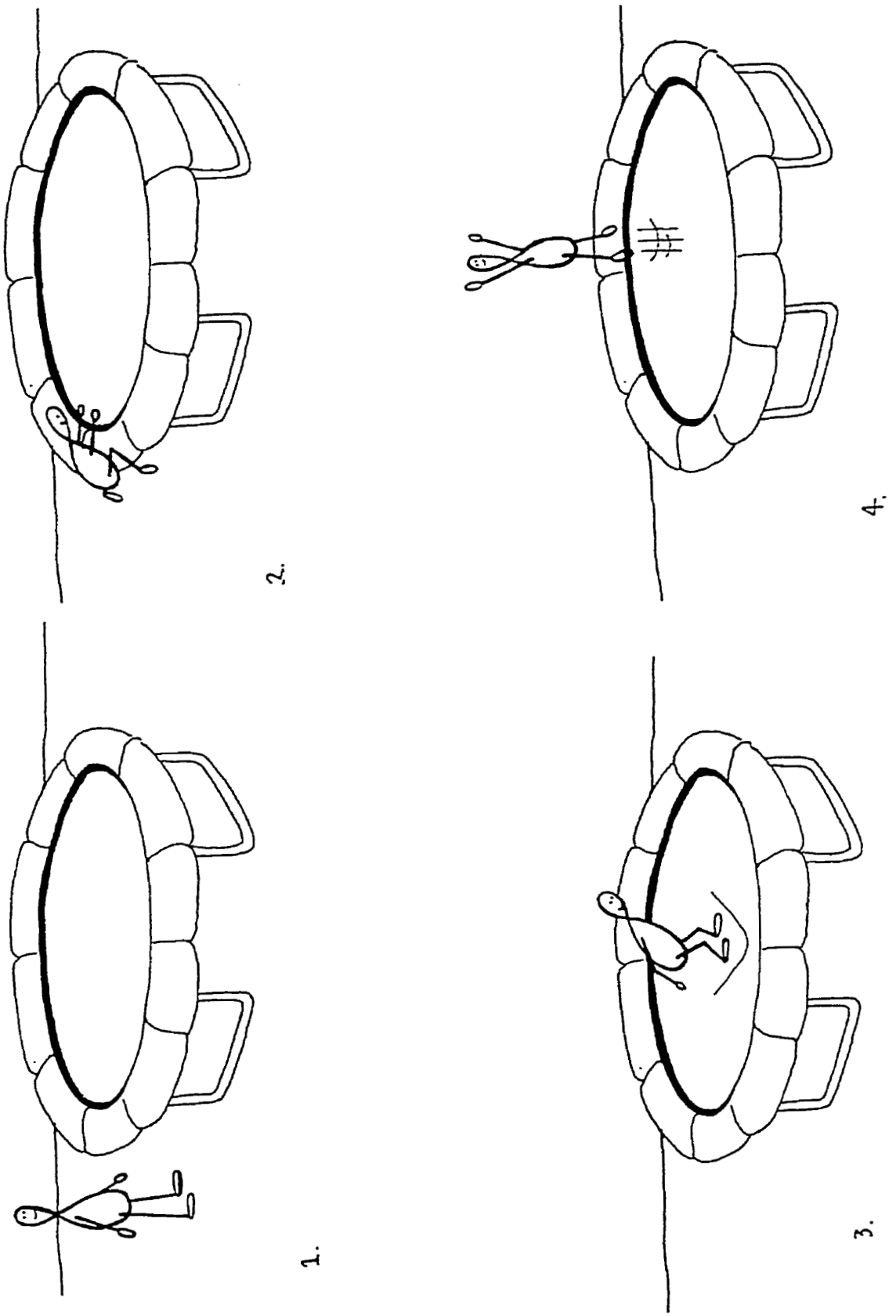
5. The child will be given the artist's manikin and the pillow. The researcher will make the following request, "Show me how this doll can jump."

In the event that the child continues to maintain interest in the various activities related to jumping for extended periods of time, again, the child would continue to be videotaped until the end of the seventy-five minute session, unless they need to begin the intervention for sliding.

Appendix Figure 6. Sample of Four Card Series of Cartoon Characters Sliding

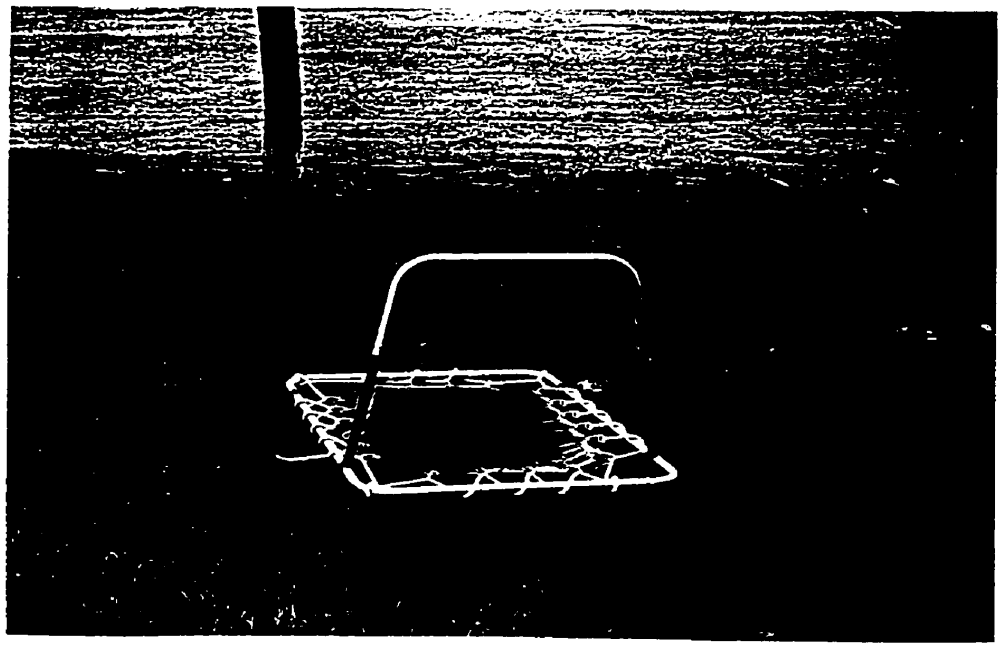


Appendix Figure 7. Sample of Four Card Series of Cartoon Characters Jumping

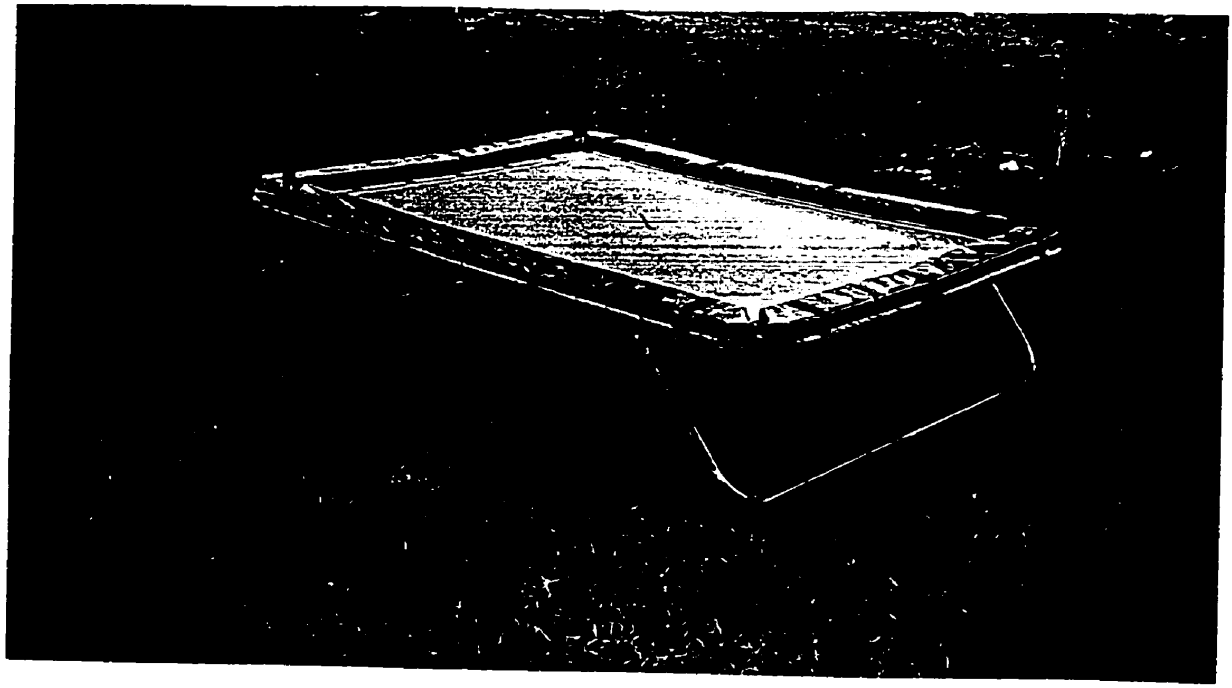


Appendix 6. Equipment Used in Intervention Room.

Appendix Figure 8. The Mini-Trampoline with the Support Bar



Appendix Figure 9. The Larger Trampoline



Appendix Figure 10. The Plastic Slide

Appendix Figure 11. Layout of Teaching Tools After Intervention