Self-Determined Behaviors of Young Children with Cerebral Palsy

A Thesis
Submitted to the Faculty
of
Drexel University
by
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in partial fulfillment of the
requirements for the degree
of
Doctor of Philosophy
September 2012
DEDICATIONS

I dedicate this work to my family whose constant love and support made this possible. My beloved parents, Cong-Ming Chang and Li-Hua Yang, have supported me unconditionally as I pursue my work. Particularly, I dedicate this work to my husband, Ching-Chieh Chou, who brings me warmth and laughter and gives me love, strength, and encouragement.
ACKNOWLEDGEMENTS

Upon the completion of this dissertation, I am thankful to many people who supported me throughout the five years of PhD study. In these five years, I am delighted to be mentored by many magnificent individuals who made this journey remarkable to me. To these people, I would like to show my immense appreciation.

I am deeply grateful to my advisor Dr. Lisa Chiarello. Her intellect and excellent guidance throughout the PhD study enabled me to accomplish this research. Dr. Chiarello has taught me to think critically, reflect what I learned, and lead me to better understanding. Dr. Chiarello also mentored me to be articulate, be crystalized, and be confident. Under her supervising, I have become a better physical therapist as well as a better person.

I wish to extend my gratitude to the distinguished faculty members who serve on my committee: Dr. Robert Palisano, Dr. Margo Orlin, Dr. Ed Gracely, and Dr. Anita Bundy. Dr. Palisano provided me invaluable and insightful comments to help me formulate my specific aims, conduct data analysis, interpret the results, and articulate the discussion. Dr. Margo Orlin provided me insightful and practical comments on interpreting the results and formulating the implication to practice. Dr. Ed Gracely assisted me by offering intelligent questions and suggestions to establish the methods and statistical analysis. Dr. Anita Bundy provided me insightful comments on playfulness and challenged my thought process on the significance of playfulness to children.

I am thankful to the Move & PLAY research team: Dr. Doreen Bartlett, Dr. Lisa Chiarello, Dr. Robert Palisano, Dr. Sally Westcott McCoy, Dr. Lynn, Dr. Alyssa, who granted me the permission to use Move & PLAY database as a secondary analysis for my research. The funding provided by the Canadian Institutes of Health Research (MOP-
81107) and the National Institute of Disability and Rehabilitation Research (NIDRR)(#H133G060254), the site coordinators, children and families who participated in the Move & PLAY study are greatly appreciated. Particularly, I would like to acknowledge the assistance I received from the Philadelphia coordinator Audrey Wood who is a sweet lady and delightful to work with.

I am grateful to the wonderful faculty, staff, and graduate students in the Department of Physical Therapy and Rehabilitation Science, Drexel University. Dr. Margaret O'Neil, Dr. Jill Maggs, and Dr. Maria Benedetto are generous to share with me their valued thoughts and provide me insightful comments for my dissertation research. Miss Debra Karlan is a caring and lovable lady who never hesitates to help me with any school-related paper work. My dear friends have been a huge support and encouragement in the past five years: Lin-Ju Kang, Sirinart Laibsirinon, Denise Begnoche, Nihad Almasri, Mihee An, and Han Chen. I will always miss the nights after the finals we had Chinese food together and shared our work and life. Without you, I could not survive these five years of being a PhD student.

Finally, I am thankful to the Hsu family, Robert, Elizabeth, Sharon, and Ian. I was inspired by Robert’s wisdom and attitudes toward life, which help me to cope with challenges from academic work and life. Elizabeth and Robert treated me as their family and provided me thoughts and support when I was frustrated. Sharon and Ian, I am convinced of the importance of playfulness to children because of your laughter and inexhaustible energy toward play.
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ABSTRACT

Self-Determined Behaviors of Young Children with Cerebral Palsy
Hui-Ju Chang, PT, PhD

Self-determined behaviors refer to children taking an active role in knowing needs, making choices, solving problems, and interacting with others. The aims of this research were to: 1) identify determinants of self-determined behaviors of children with cerebral palsy (CP); and 2) determine whether self-determined behaviors, frequency, and enjoyment of participation differed between children who are more playful and less playful.

Participants in study I were 429 children with CP (18 to 60 months, 56% boys) and their parents. The measures were the Early Coping Inventory, Test of Playfulness (ToP), Gross Motor Function Classification System (GMFCS), Health Conditions for Children with CP, Family Expectation of Child, and Family Support to Child. Structural equation modeling was used to test two models of self-determined behaviors. For children with walking mobility (GMFCS levels I-II), the model explained 60% of variance in self-determined behaviors. The determinants were cognitive-behavioral function and family provided opportunity to support their child’s self-determined behaviors. For children with limited mobility (GMFCS levels III-V), the model explained 68% of variance in self-
determined behaviors. The determinants were cognitive-behavioral function, playfulness, and family provided opportunity.

Participants in Study II were 127 children with CP: walking mobility (more playful, n=40; less playful, n=39) and limited mobility (more playful, n=24; less playful, n=24). The measures were Early Coping Inventory, Child Engagement in Daily Life measure, ToP, GMFCS, and Health Conditions for Children with CP. ANCOVA or Mann-Whitney U test was used to examine the difference of playfulness on dependent variables based on number of covariates. Children with walking mobility who are more playful had more effective self-determined behaviors than children who are less playful (p<.02). Children with limited mobility who are more playful had greater enjoyment of participation than children who are less playful (p<.01).

The findings support children’s learning and understanding, communication, controlling emotions and behaviors, playfulness, mobility, and family provided opportunity for their child to try things as important considerations to support self-determined behaviors. Service providers are encouraged to appreciate the multi-dimensional nature of self-determination, support children from a holistic perspective, and value team collaboration to enhance children’s self-determined behaviors.
CHAPTER 1: RESEARCH PROPOSAL

1.1 Specific Aims

Self-determination is an attribute of an individual to take responsibility and advocate for personal life goals free from external interference. Self-determined behaviors are developmental processes of acquiring the skills necessary to foster self-determination. These skills include identifying what one wants, decisions making, problem solving, and actively pursuing one’s interests. Young children display and practice self-determined behaviors in daily activities. Children with cerebral palsy (CP) have a life-long disorder of posture and movement, which limits their physical ability and daily activities. Children with CP are often more dependent on parents and family and have fewer opportunities to make choices and decisions on their own compared to children without disabilities (Andersson & Mattsson, 2001; Wehmeyer, 1996). As a consequence, children with CP may be at risk of developing limited self determined behavior and restricting engagement in life situations. The development of self-determined behaviors begins in early childhood and requires support and nurturance. Although early childhood is thought to be a sensitive period for development, the determinants of self-determined behaviors of children with CP have not been identified.
Play is the primary occupation of young children and a potential means for developing self-determination. Playfulness is the behavioral attribute of the child, an approach to play illustrated by flexibility, spontaneity and highly-spirited fun. Playfulness and self-determined behaviors are both characterized by motivation, internal locus of control, and engagement. Activity limitations of children with CP impact their ability to manually play with toys and move about. Playfulness may serve an important role in enabling young children with CP opportunities to practice self-determined behaviors.

Child characteristics (motor function, communication, cognition, emotion / behavioral problems, and age), family characteristics (family provided opportunity to support their child’s self-determined behaviors and socioeconomic status) and environmental characteristics (accessibility) have been proposed as the determinants of self-determination in young children with disability (Brotherson, Cook, Erwin, & Weigel, 2008; Zhang, 2005). The readiness to express self-determination is associated with age-related development skills, including motor function and communication. Parents of children with CP provided fewer opportunities for their children to practice self-determined behaviors than parents of children with typical development (Zhang, 2005). Furthermore, evidence suggests that families with lower socioeconomic status less frequently encourage self-determined behaviors for their children with CP than families
with higher socioeconomic status (Zhang, 2005). Although one study (Brotherson et al., 2008) supported that family and home environment provided opportunities to enable young children with disabilities to develop self-determined behaviors, there is a need for knowledge on how self-determined behaviors are influenced by child, family, and environmental characteristics.

The long-term goal of this research is to identify the service, strategies, and support that will enable families, professionals and children themselves to optimize self-determination. The objectives of this dissertation proposal are to identify the child, family and environmental determinants of self-determined behaviors and the effects of playfulness on self-determined behaviors of young children with CP. The central hypotheses are that child variables have the highest magnitude of relationship with self-determined behaviors and children who are playful have more self-determined behaviors than children who are less playful. The proposed study is an important step in the discovery of the dynamics of the child, family and environmental factors that influence self-determined behaviors of young children with CP. My experience as a graduate research assistant in data collection, data management and analyses pertaining to playfulness, family ecology, and participation and priorities of children with CP and preliminary analyses have prepared me to perform this study.
To accomplish the objectives, two specific aims are proposed:

**Specific Aim #1: Identify child, family and environmental variables that together are determinants of self-determined behaviors of young children with CP**

**Working hypothesis #1:** Child’s playfulness, motor function, age, and cognitive-behavioral functioning (communication, cognition, and emotional / behavioral status) will have a direct relationship with self-determined behaviors that is of higher magnitude than family and environmental variables.

**Working hypothesis #2:** Family provided opportunity to support their child’s self-determined behaviors will have both a direct relationship and an indirect relationship via playfulness with self-determined behaviors.

**Working hypothesis #3:** Family socioeconomic status will have an indirect relationship with self-determined behaviors via family provided opportunity to support their child’s self-determined behaviors.

**Working hypothesis #4:** Physical environment will have both a direct relationship and an indirect relationship via playfulness with self-determined behaviors.
Specific Aim #2: Determine the differences in self-determined behaviors, participation and enjoyment between children with CP who are more playful and children with CP who are less playful.

Working hypothesis #1: Children with CP who are more playful (top 25%) will have more effective self-determined behaviors than children with CP who are less playful (lowest 25%).

Working hypothesis #2: Children with CP who are more playful will participate in daily life activities more than children with CP who are less playful.

Working hypothesis #3: Children with CP who are more playful will enjoy participation more than children with CP who are less playful.

This proposed study is innovative because it is among the first to identify child, family and environmental determinants of self-determined behaviors of young children with CP and whether children who are more playful are more self-determined. Knowledge of the determinants of self-determined behaviors will guide families and service providers in encouraging children with CP to develop self-determined behaviors. Knowing the effects of playfulness on self-determined behaviors will provide evidence to expand clinical practice from focusing primarily on motor function to also supporting playfulness. This knowledge can have a positive impact on the life outcomes and well
being of young children because it will support their engagement in life situations that are meaningful to them.

1.2 Background and Significance

Self-Determination and Self-Determined Behaviors in Young Children

Self-determination has been considered a desirable outcome for children with cerebral palsy (CP) as advocated by both the rehabilitation and special education fields (Algozzine, Browder, Karvonen, Test, & Wood, 2001; Wehmeyer, 2001). Self-determination is defined as an attribute of an individual to take responsibility and advocate for personal life goals free from external interference (Brotherson et al., 2008; Shogren & Turnbull, 2006; Ward, 1988; Wehmeyer, 1992, 2001). The characteristics of self-determination include knowing what he or she wants (self-awareness), planning how to reach for the goals (problem-solving & decision making), and advocating for one’s interests (self-advocacy) (Brotherson et al., 2008; Ward, 1988).

Awareness of the importance of self-determination in children with disabilities has increased in the past two decades. Self-determination has been recognized as an ultimate goal in special educational field and a means to achieve the desired outcomes of self-actualization and the optimal level of independence for children with disabilities (Wehmeyer, 1996). The U.S. Department of Education, through the Individuals with
Disabilities Education Act (PL 101-476) and the Amendment of the Rehabilitation Act (PL102-569), has identified children, youth, and adults with disabilities have a right to self-determination.

“Disability is a natural part of the human experience and in no way diminishes the right of individuals to live independently, enjoy self-determination, make choices, contribute to society, pursue meaningful careers and enjoy full inclusion and integration in the economic, political, cultural, and educational mainstream of American society (the Amendment of the Rehabilitation Act, Sec.2(a)(3)(A-F)).”

Specific to the practice of physical therapy, the Section on Pediatrics of the American Physical Therapy Association, values self-determination for the child to optimize outcome and well being (Section of Pediatrics APTA, 2001).

The process of self-determination is associated with fulfillment of human psychological needs (Deci & Ryan, 2000b; Poulsen, Rodger, & Ziviani, 2006). Psychologists assert that individuals have innate psychological needs of engaging with their environments (competence), mastering personal behavior (autonomy), and making connections with others (relatedness) (Deci & Ryan, 2000a, 2000b). The process of fulfilling one’s needs and practicing self-determination leads to satisfaction and well being in life (Deci & Ryan, 2000b; Poulsen et al., 2006).
Children with CP deal with additional challenges in fulfilling the needs and practicing self-determined behaviors than their peers without disability. Children with CP have a life-long disorder of posture and movement that limits their physical ability (Rosenbaum et al., 2005). Children with CP require additional support and opportunities to assist them in developing and practicing self-determined behaviors. Children with CP had fewer opportunities to make choices and engage in activities, which were suggested to be factors restricting the development of their self-determined behaviors (Bannerman, Sheldon, Sherman, & Harchik, 1990; Zhang, 2005). While transitioning to adulthood, youth with CP demonstrated low rates of post-secondary education and employment, less participation in recreational and social activities, and more dependence on parents and family (Andersson & Mattsson, 2001; Wehmeyer, 1996). Consequently, they may be at risk of limited development of self-determination and restricts their ability to engage in life situations. Research evidence suggested that adolescents with disabilities who developed better self-determination skills achieved better outcomes, such as higher employment rate and better health status (Wehmeyer et al., 2003; Wehmeyer & Palmer, 1997). Therefore, promoting self-determination of children with CP is crucial.

Development of self-determination is considered to begin in infancy (Doll, Sands, Wehmeyer, & Palmer, 1996; Wehmeyer, 2000). Early childhood is considered a sensitive
period to establish the foundation (Brotherson et al., 2008; Erwin & Brown, 2003; Shogren & Turnbull, 2006). Self-determination is not a term used to describe young children since they have not fully developed self-determination. However, there are some essential behaviors that are important for the development of self-determination. These behaviors are referred to as self-determined behaviors in this proposal project. For example, infants begin to explore and interact with the world through manipulating toys that hold their attention (Brown & Cohen, 1996). Through this process of exploration, infants develop their own preferences, personal identity, and goal-directed behaviors (Brown & Cohen, 1996). After 18 months of age, toddlers have developed speech and are able to express their needs through simple verbal communication (Bronson, 2000). They make choices during games and playtime, such as voicing their desire to go outside to play. Toddlers also begin to internalize self-regulation and preferences and show the potential to adapt their behaviors in attempting to achieve their goals (Jennings, 2004). Preschoolers have attained sufficient motor abilities to explore the world independently and interact with the environment, peers and adults for physical and social experiences. They are able to verbalize their goals, select and plan simple strategies, perform tasks, and solve simple problems (Wehmeyer & Palmer, 2000).
Brown and Cohen proposed five critical self-determined behaviors in young children that are considered building blocks for the development of self-determination (Brotherson et al., 2008; Brown & Cohen, 1996). The five self-determined behaviors or building blocks of self-determination include: (1) expressing preference and choice; (2) participating in decision making; (3) exhibiting self-awareness; (4) displaying engagement and persistence; and (5) exercising increased appropriate control over the environment. Similarly, Doll and her colleagues (1996) developed a framework of self-determined behaviors for children and adolescents from 2 to 18 years of age. Their framework contains five categories of self-determined behaviors: self-awareness and self-knowledge, self-evaluation and efficacy, choice and decision making, meta-representation, and goal setting and attainment. Meta-representation refers to the process of externalizing thoughts into actions to create effective social interaction (Doll et al., 1996). The early childhood stage (2-5 years of age) of the framework supported the five building blocks of children’s self-awareness, choice making, decision making, engagement and persistence. However, little is known about how to assess self-determined behaviors in young children and the potential important child, family and environmental factors that optimize the development of these behaviors.
Through reviewing the published literature, no measure has been identified to examine self-determined behaviors in young children. The construct of adaptive behavior for young children, as measured by the Early Coping Inventory, matches the construct of self-determined behaviors described by Brown and Cohen and Doll and her colleagues. Conceptually, adaptive behavior describes the process that a child adapts his or her behavior to meet personal needs and to manage interactions with the environment. The description matches the key processes of self-determined behaviors regarding fulfillment of innate human needs and engagement in daily life. Both adaptive behavior and self-determined behaviors are related to functioning in daily life to achieve mastery through negotiation and interaction with the environment or people. Therefore, adaptive behavior, as measured by the Early Coping Inventory, is proposed as a reasonable approach to initially understand self-determined behaviors in young children.

It is important to note that in early childhood children learn and practice these self-determined behaviors primarily through play. I believe that play serves an important role in the developmental process of competence, self-efficacy and self-determination.

**Playfulness**

Play is considered as the primary occupation of young children (Bundy, 1991) and a potential means for developing self-determined behaviors. Children develop motor skills,
sensory processing, and social skills through play (Bundy, 1991; Chiarello, Huntington, & Bundy, 2006; Rubin, Fein, & Vandenberg, 1983). Play is defined as a physical or mental leisure activity, which is purely for enjoyment or amusement (Bundy, 1997; Rubin et al., 1983). Playfulness refers to the behavioral attribute of the individual that is characterized by flexibility, spontaneity and highly-spirited fun. Playfulness relates to the quality of the play regardless of the type of play activity or the physical ability of the player (Bundy, 1997; Hamm, 2006; Hess & Bundy, 2003; Rubin et al., 1983).

Bundy proposed four elements of playfulness: intrinsic motivation, internal control, freedom to suspend reality and framing (Bundy, 1997). A continuum of playfulness presented the interaction of these four elements and refers to the playfulness of a child: 1) Intrinsic motivation refers to having self-interests, initiating action and involvement in activity; 2) Internal control reflects a child’s belief that he or she is responsible for his or her behavior; 3) Freedom to suspend reality connotes that the child is not restricted to what is real and shows creativity such as pretend or imaginary play; 4) Framing describes reading cues of others, responding to others, and maintaining the engagement of a play structure when interacting with others (Bundy, 1997, 1998). The four elements of playfulness reflect the presence of the trait during play. Test of Playfulness is the measure developed by Bundy et al. (2001) to examine the four elements of playfulness of children.
Research on the expression of playfulness in children with physical disabilities is inconclusive but there is some evidence to suggest that children with CP could potentially be playful with environmental support (Harkness & Bundy, 2001; Rigby & Gaik, 2007). Several authors have reported that children with CP demonstrated less playfulness than children with typical development (Bundy, Nelson, Metzger, & Bingaman, 2001; Chiarello et al., 2006; Hamm, 2006; Okimoto, Bundy, & Hanzlik, 2000), whereas others have found that children with physical disabilities did not differ from their peers with typical development (Harkness & Bundy, 2001). Harkness and Bundy (2001) indicated that the environment is a potential important support to promote playfulness in children with physical disabilities. Further, Rigby and Gaik (2007) reported that the children with CP were more playful at home than in the community and school. This finding implies that the environment may influence the expression of playfulness of children with CP. The setting and modification of the environments may be external supports to enable children to participate in play.

The Intertwining Concepts of Playfulness and Self-Determined Behaviors

The constructs playfulness and self-determined behaviors are both characterized by motivation, internal locus of control, and engagement. Motivation is characterized by knowing himself or herself, experiencing competence and experiencing stimulation
through fulfilling of enjoyment (Poulsen et al., 2006). An intrinsically motivated person exhibits a high level of interest, curiosity, confidence, persistence and creativity. This characteristic also is inherent in child’s play. Child’s play is often motivated by curiosity and interest in an activity that is enjoyed without the need for external rewards.

A person with an internal locus of control makes decisions, solves problems and learns from experiences to achieve perceived control in one’s life (Wehmeyer, 1999). Internal locus of control is evidenced in self-determined behaviors through a sense of competence to achieve the outcome (Grolnick, Gurland, & Jacob, 2002). Playfulness suggests that the individual is responsible for his or her actions. Both concepts address the importance of mastering one’s own life.

Engagement describes the persistent positive and age-appropriate attention to an activity or an interaction with others (Brotherson et al., 2008; Odom & Bailey, 2000). A self-determined person engages in activity through making choices and interacting with people and environments. Also, framing, one of the components of playfulness, refers to the ability of the child to interact with people and environment through giving and reading social cues.

As play serves an important role in preparation for adult performance (Blanche, 1997), I believe that playfulness has an important role in development of self-determined
behaviors in young children. From the descriptions of playfulness and self-determined behaviors, however, there are some unique constructs that separate them. First, self-determination and playfulness may both be observed or expressed in a variety of life activities. Comparatively, playfulness is primarily observed in recreational and leisure activities, such as play. Self-determination is relatively shown in occupation, academic work, or other goal-oriented life situations. Second, playfulness is characterized by a unique component, freedom to suspend reality, which involves humor and creativity. A child has freedom to choose the degree he or she is constrained by reality when expressing playfulness. Self-determination is also related to creativity but reflects more realism in pursuing one’s goal. Lastly, playfulness and self-determination both enjoy the process and value the outcome. In terms of playfulness, child may engage an activity simply because they enjoy it rather than primarily for the end product. Compared with playfulness, self-determined behaviors are relatively more goal-oriented and emphasize the ultimate outcome of self-actualization.

Model of Self-Determined Behaviors in Young Children with CP

The proposed study aims to identify the child, family and environmental variables that are the determinants of self-determined behaviors of young children with CP. Figure 1 presents the conceptual framework of self-determined behaviors of young children with
CP. The child, family and environmental characteristics are three major proposed important factors contributing to self-determined behaviors of young children with CP. The model is a dynamic pattern and reflects the reciprocal relationship among and between the three characteristics and self-determined behaviors. The three characteristics are continuously interacting together and contributing to the development of self-determined behaviors and vice versa.

Figure 1 The Conceptual Framework of Self-Determined Behaviors of Young Children with CP
Table 1 presents the proposed determinants of self-determined behaviors in young children with CP. The proposed child characteristics are playfulness, motor function, communication, cognition and cognitive-behavioral functioning (communication, cognition, and emotional / behavioral status) and age. Child characteristics represent the child’s capacity related to knowledge, abilities and perceptions that enable a child to be self-determined. Therefore, I propose that child characteristics have the highest contribution on child’s self-determined behaviors. The family characteristics include family provided opportunity to support their child’s self-determined behaviors, parent education and household income. The environmental characteristics include modification of the environment and assistive technology. Family and environmental characteristics are the opportunities and resources that enable a child to use knowledge
and ability to practice self-determined behaviors. Therefore, family and environmental characteristics contribute to the opportunities for developing self-determined behaviors and account for the variance of the children’s development of self-determined behaviors. This proposed study will examine the relationship of child, family and environmental characteristics together on self-determined behaviors of young children with CP in Specific Aim 1. The Specific Aim 2 will examine the effect of playfulness on self-determined behaviors when minimizing the confounding factors of motor function, age, communication and cognitive functioning and family provided opportunity.

*Child Determinants*

Child determinants include playfulness, motor function, communication, cognition and cognitive-behavioral functioning (communication, cognition, and emotional / behavioral status) and age. This study proposes that playfulness is the most important factor to self-determined behaviors in virtue of the proposed interweaving concepts of playfulness and self-determined behaviors including motivation, internal locus of control and engagement.

The readiness to express self-determined behaviors is associated with age-related developmental skills, which include motor function and cognitive-behavioral functioning. Age-related developmental skills in early childhood are associated with self-determined
behaviors, such as preferences, choices and self-regulation (Erwin & Brown, 2003). The previously discussed age-related framework (Doll et al., 1996) or building blocks of self-determination (Erwin & Brown, 2003) has been conceptualized but has not been empirically demonstrated. Thus, age seems to be a factor to self-determined behaviors. However, for children with CP age has been demonstrated as a less important predictor of several outcomes than motor function ability. Therefore, the effect of age on self-determined behaviors of young children with CP is unknown (Doll et al., 1996).

Motor function ability has been demonstrated an important predictor of various child outcomes, such as participation and quality of life (Beckung & Hagberg, 2002; Law et al., 2007; Majnemer, Shevell, Rosenbaum, Law, & Poulin, 2007). However, the impact of physical disability on self-determined behaviors in children with CP has not been identified yet.

Self-determined behaviors require the expression of preferences and choices through some means of communication such as gestures and language. Wehmeyer and Palmer (2000) asserted that children with communication difficulty required additional support to express preference and needs. Difficulties in communicating needs and making decisions could be barriers to practice self-determined behaviors (Erwin & Brown, 2003). Cognition has been demonstrated as a factor of self-determined behaviors (Wehmeyer,
Wehmeyer (1999) suggested that the expression of self-determination skill is negatively associated with intellectual ability in adolescents. Children with intellectual disability required additional support to identify their preferences (Wehmeyer & Palmer, 2000). Although communication and cognition were suggested as the potential factors to self-determined behaviors, the influence of the impairments on self-determined behaviors is not determined in young children. Emotional / behavioral status is a potential factor of development of self-determined behaviors (Brotherson et al., 2008). Children’s emotional / behavioral status is associated with the strategies family used to support self-determined behaviors of children (Brotherson et al., 2008). In addition, one study demonstrated that emotional / behavioral problems explained a significant variance of adaptive behavior in young children with CP (Chiarello, Almasri, & Palisano, 2009). Therefore, emotional / behavioral status seems to be a factor to self-determined behaviors of young children with CP.

**Family Determinants**

In early childhood the family is considered the primary influence on child’s development (Wehmeyer & Palmer, 2000). Parents’ habits, preferences and beliefs have great influence on the development of their children. Several perspectives have discussed the importance of family ecology for young children on the development of their self-
determined behaviors (Brotherson et al., 2008; Brown & Cohen, 1996; Shogren & Turnbull, 2006). Family provided opportunity potentially gives young children more chances to develop and practice optimal self-determined behaviors. However, there is no direct evidence demonstrating the relationship of family provided opportunity to support their child’s self-determined behaviors and self-determined behaviors of young children.

Family socioeconomic status was suggested to be associated with family provided opportunity to support their child’s self-determined behaviors (Zhang, 2005). Parents with higher income and education levels provided more opportunities for their children with CP to practice self-determined behaviors (Zhang, 2005). Zhang (2005) indicated that the parents of higher socioeconomic status often involve their children in discussing interests, making daily decisions, planning recreational activities, setting goals and experiences, which are thought to promote the development of self-determined behaviors. However, the link between family provided opportunity to support their child’s self-determined behaviors and development of self-determined behaviors is not established yet.

*Environmental Determinants*

Different settings, such as home, school or community, were suggested to influence children’s ability to practice self-determined behaviors (Wehmeyer, 1999, 2001; Zhang,
Wehmeyer, & Chen, 2005). Home is considered the primary place in which children learn and practice self-determined behaviors (Wehmeyer & Palmer, 2000). The naturally occurring opportunities in the home help children with CP learn to access the environment, make choices and take actions (Jolivette, McCormick, McLaren, & Steed, 2009). Brotherson et al. (2008) suggested that alternative strategies to the tasks and modification to the home allow children with CP to make choices and actions on their own rather than getting help from the family. Also, for some children with CP, task adaptation using assistive technology enables engagement in life activities, such as self-care or participation in family and community activities. Knowledge of the environmental influence is needed to account for the variance of the children’s development of self-determined behaviors.

**Significance of the Proposed Research**

Self-determined behaviors are important for children with CP to optimize their life outcomes. In spite of the increased attention on self-determined behaviors of young children in the past 2 decades, there is still a gap in the knowledge on how child, family and environmental determinants influence self-determined behaviors of children with CP. The results of the proposed study should increase knowledge of self-determined behaviors of young children with CP and guide further research leading to clinical
application. The proposed study has implications for families and service providers in promoting the development of self-determined behaviors of young children. Knowledge of the determinants of self-determined behaviors will provide information on the factors that need to be considered when setting up interventions and strategies to promote development of self-determined behaviors. Knowledge of the effects of playfulness on self-determined behaviors will have an implication to support playfulness in promoting the development of self-determined behaviors of young children with CP. The knowledge of this project is expected to have a positive impact on life outcomes and well-being of young children with CP because it will support their engagement in life situations that are meaningful to them.
1.3 Previous Work Related to Dissertation

Beginning in Fall 2007 I participated in four research projects related to my dissertation topic: 1) psychometrics of the Child Engagement and Daily Life Measure (Chiarello & Chang, 2009) and the Health Conditions for Children with CP (Bartlett, Chiarello, & Chang, 2009); 2) descriptive properties of the Child Engagement in Daily Life Measure (Chiarello & Chang, 2009); 3) descriptive properties of Test of Playfulness (ToP) (Chiarello & Chang, 2010); and 4) participation of young children with CP (Chang, Chiarello, & Palisano, 2010). The first three projects were part of the Movement and Participation in Life Activities in Young Children with Cerebral Palsy (Move & PLAY) study. The last project was part of the Children’s Activity and Participation study (CAPS).

Psychometric properties of the Child Engagement in Daily Life Measure and the Child Health Conditions for Children with CP

The aim of this project was to evaluate test-retest reliability of the Child Engagement in Daily Life Measure and the Health Conditions for Children with CP. Thirty-three children with CP and their parents participated in the study. Parents completed both questionnaires twice in an average interval of 23 days. Test-retest reliabilities (ICC (2,1)) of the Child Engagement in Daily Life Measure were .70 (95%CI=.47 to .84) for Participation, .70 (95%CI=.47 to .84) for Enjoyment, .96
(95% CI=.91 to .98) for Self-Care Ability, and .76 (95% CI=.56 to .87) for Ease of Care Giving (Chiarello & Chang, 2009). The test-retest reliabilities (ICC (2,1)) of the Health Conditions for Children with CP were .80 for number and ICC .85 for average impact of the health conditions (Bartlett et al., 2009). The results demonstrated that the Child Engagement in Daily Life Measure and Health Conditions for Children with CP are reliable measures.

**Child Engagement in Daily Life Measure**

The aim of this project was to examine the performance of young children with CP on the Child Engagement in Daily Life Measure. Three hundred and thirty four children with CP, 18 months to 5 years old, and their parents participated in the study. The parents completed the questionnaire regarding their children’s participation, enjoyment, self-care ability, and ease of care-giving. Three-way ANOVAs were conducted to determine differences among 3 age groups (17-30, 31-42, and 43-60 months), gender (52% boys), and 5 GMFCS levels. The results demonstrated that, on average, children participated once in awhile to often (m=3.7, SD=.69) and enjoyed participation very much (m=4.17, SD=.74). A two-way interaction on participation was present between gender and age group (p<.01). Boys in the youngest age group (17-30 months) participated less than boys in the two older age groups (p<.001). Girls in all age groups had similar participation.
Overall, children in the two older age groups participated more often and enjoyed their participation more than children in the younger age group (p<.01). Children in GMFCS level V participated less than children in levels I, II and IV and enjoyed their participation less than children in levels I and IV (p<.01). Children in GMFCS level III participated less than children in level I (p<.01). Boy and girls have similar enjoyment.

In self-care, on average, the children required constant help to help for part of the activity (m=2.57, SD=1.06) and caregivers reported little to no difficulty (m=3.73, SD=.74) in helping their children. A two-way interaction on self-care ability was present between GMFCS level and age group (p=.001). For children in GMFCS level I, the oldest age group were independent in self-care the most, followed by children in the middle age group, with children in the youngest age group being more dependent in self-care (p<.001). For children in GMFCS level IV, the oldest age group were more independent in self-care than the children in the youngest age group (p<.01). For children in GMFCS levels II, III and V, there was no difference in self-care across the age groups. Overall, children in the oldest age group were more independent in self-care, followed by children in the middle age group, with children in the younger age group requiring more help (p<.001). Children in GMFCS level I were more independent in self-care and children in level V were more dependent than children in the other GMFCS levels.
Children in levels II and III had higher self-care ability than children in level IV (p<.001). Ease of care giving was similar for all age groups. Caregivers reported higher ease of care giving for children in GMFCS level I compared with caregivers of children in all other levels (p<.01), higher in II than IV and V (p<.01), and higher in III than V (p<.001). Boys and girls had similar self-care, and ease of care giving.

Playfulness of Young Children with CP

The aim of this project was to describe playfulness of young children with CP and examine the differences based on age, gender and motor functions. Three hundred and ninety-three children with CP (m=38 months of age, SD=11.3; 17-59 month) and their parents participated in the study. The playfulness is measured with Test of Playfulness. Trained therapists observed and scored the children’s playfulness during a 10-20 minute play session with their parent. The playfulness score is done with Rasch Analysis. Three-way ANOVA was conducted to examine differences of playfulness based on gender (56% boys), age (17-30, 31-42, and 43-60 months), and motor function (GMFCS level I, II/III, and IV/V). The results demonstrated that on average the children’s playfulness score was .17 (SD=1.05). Children’s playfulness did not differ by gender. A significant interaction was found between age and motor function (p<.05). For all age groups, children in GMFCS level I were more playful than children in GMFCS levels IV/V.
In GMFCS level I children older than 42 months were more playful than children younger than 31 months (p=.001). For children younger than 43 months, those in GMFCS levels II/III were more playful than children in GMFCS levels IV/V (p<.001). For children older than 42 months, children in GMFCS level I were more playful than children in GMFCS levels II/III (p<.01).

**Participation of Young Children with CP**

The aim of this project was to examine differences in the number and frequency of participation in leisure and recreational activities of young children with CP based on age, gender and GMFCS level. Eighty-two children with CP, from 3.1 to 5.9 years of age, and their parents participated in the study. Children were grouped by age (< 4 years, 4- 5 years and 5-6 years of age), gender (60% boys), and GMFCS group (I, II/III and IV/V). Parents completed the Preschool Children’s Assessment of Participation and Enjoyment (Preschool CAPE) regarding their children’s diversity and intensity of participation. The overall diversity, overall intensity, and diversity and intensity scores for four activity types (play, skill development, active recreation, and social) were calculated. The effect of age and GMFCS level were analyzed using the Kruskal-Wallis ANOVA. Gender differences and post-hoc multiple comparison tests were performed using the Mann-Whitney U test. The results demonstrated that children participated in a mean of 27
(60%) of the 45 activities. The mean percentage of activities done for each activity type varied from 74% (play) to 52% (active physical recreation). The effect of age was significant for diversity ($\chi^2 = 7.50$, $p<.05$) and intensity of social activity ($\chi^2 = 6.15$, $p<.05$). Multiple comparison tests indicated that children 5-6 years did more social activities than children < 4 years ($p<.02$). The effect of GMFCS level was significant for overall diversity ($\chi^2 = 6.35$, $p<.05$) and diversity of skill development ($\chi^2 = 7.58$, $p<.05$). Children in Level I did more skill development activities than children in Levels IV/V ($p<.02$). Participation did not differ between boys and girls.

**Preliminary Work**

In preparation for my dissertation research, I examined the construct of adaptive behavior measured by the Early Coping Inventory that was used in the Move & PLAY study. To my available knowledge, there is no measure designed to examine self-determined behaviors of children under 5 years old. The purpose of the work was to determine whether the score of the Early Coping Inventory, a measure of adaptive behavior, could be used to reflect a young child’s self-determined behaviors. Although young children have not fully developed self-determination, they demonstrate some essential behaviors that are considered the building blocks of self-determination. While examining the content of the Early Coping Inventory, I discovered that the descriptions of
the measure and items matched the concept of self-determined behaviors of young children. Conceptually, adaptive behavior describes the process that a child adapts his or her behavior to meet personal needs and to manage the interaction with the environment. The description matches the key processes of self-determined behaviors regarding fulfillment of innate human needs and engagement in daily life. Both adaptive behavior and self-determined behaviors is related to the functioning in daily life to achieve mastery through negotiation and interaction with the environment or people. On the item level, appendix 2 presents the parallel between self-determined behaviors and items on the Early Coping Inventory. For example, one of the self-determination characteristics is preference. On the Early Coping Inventory, one question asks “child expresses likes and dislikes.” The question was matched with preference as one component of self-determined behaviors. While investigating the Early Coping Inventory, I attempted to regroup the selected items which best represented the concept of self-determined behaviors. However, I also realized that the descriptions of the adaptive behavior items may match more than one component of self-determined behaviors because these behaviors are an integrated processes. For example, ‘child maintains visual attention to people and objects,’ relates to making choices and showing preferences as well as persistence in maintaining one’s attention on things. Cronbach’s alpha and correlation
coefficients of selected items were analyzed and demonstrated that the 48 items were holding together to represent a concept as a whole (Cronbach’s alpha = .98). Therefore, I believe that adaptive behavior index is appropriate to represent self-determined behaviors of young children.

Second, family provided opportunity to support their child’s self-determined behaviors was adapted from 8 selected items from 3 questionnaires (Family Support to Child (FSC), Family Expectations of Child (FEC) and Family Environment Scale). Face validity was used in selecting the items of family beliefs and behaviors that are consistent with practice related to promotion of self-determination. For example: the extent the family expects the child to try everything. Although this variable may not be able to demonstrate the whole spectrum of opportunity for self-determined behaviors, this project is an important initial step to explore the importance of family ecology on self-determined behaviors and to help design future study.

Third, the presence of assist technology for motor and communication was adapted from the usual Mobility questionnaire and Health Conditions for Children with CP. Because of the heterogeneous characteristics of children with CP, the use of assist technology is difficult to determine. Greater amount of special equipment does not necessarily mean better functional performance or adaptation. Due to the limitation of
available data, I chose to include this variable only for children who usually require the assistive device in mobility activities, which are children in GMFCS level III to V. The appendix provides the detailed description for calculation of this variable.

Reflection

The experiences I learned from the four projects helped me develop my proposed study. First, I gained skills in data collection, data management and data interpretation. I had the opportunity to participate in Move & PLAY study assessor training procedures and passed the criterion tests. I participated in the study home visits and personally collected the data for some of the families in Move & PLAY database, which I will use for the dissertation. The experience was particularly helpful in developing my research questions. Through experiencing interactions with the participants and hearing from parents regarding care-giving for their children with CP in all five GMFCS levels, I learned the needs, priorities and perspectives of the families.

I also participated in data management from data cleaning, data entry with SPSS Entry Builder software (SPSS, Chicago, IL, USA), data checking and data storage. These processes enabled me to be more detail-orientated and precise related to data accuracy. I assisted with data processing, data analysis and data interpretation. While doing data management, I appreciated the importance of investigating the distribution of the data
and verification of consistency and accuracy. A clear understanding of the data has enabled me to select appropriate statistics for my proposed study. Furthermore, I participated in the regular meetings for the Move & PLAY study and CAPS study. The presentations, interpretation of results and discussions among the faculty and students enabled me to consider in-depth levels and possibilities regarding study design for my dissertation proposal.

My experience in collaborating on the dissemination of the results of these projects includes: 1) Move & PLAY Education Workshop in Combined Sections Meeting 2009, American Physical Therapy Association (APTA); 2) two posters for the 63rd Annual Meeting, American Academy for Cerebral Palsy and Developmental Medicine (Bartlett et al., 2009; Chiarello & Chang, 2009); 3) one platform (Chiarello & Chang, 2010) and two poster presentations for the Combined Sections Meeting 2010, APTA (Chang et al., 2010; Maggs et al., 2010). I attended the last conference to present the poster regarding participation of young children with CP (Chang et al., 2010). The opportunity to present the results and interpretation of results required a comprehensive understanding of the research project. The feedback and discussions with clinicians helped me think deeper and broadened my horizon in translating the knowledge from research to clinical practice.
I have made two decisions for my dissertation based on the results of the four projects I participated in, which are related to the issue of gender, age and motor function. First, there was a consistent finding among the projects - boys and girls have similar participation, enjoyment and playfulness (Bartlett et al., 2009; Chang et al., 2010). Based on this experience, literature review, and personal belief, I will not consider gender as a factor for self-determined behaviors. Second, age and GMFCS level had effects on the playfulness of the children with CP. I needed to consider these two confounding factors while using playfulness score as a grouping variable. Therefore, I decided to conduct the analysis on two groups of children who walked without device (GMFCS level I-II) and children who walked with restriction or unable to walk (GMFCS level III-V). For each group, I stratified the participants with age to minimize the age effect.

1.4 Research Design and Methods

The proposed study will be examined by secondary analysis with the Move & PLAY database, which is a prospective longitudinal study to understand the determinants of motor abilities, self-care and play of young children with CP (Bartlett et al., 2010)(Funded by the Canadian Institutes of Health Research and the National Institute of Disability and Rehabilitation Research). I have permission from the investigators to use the Move & PLAY database for the specific aims of my dissertation.
Participants

The participants are 430 children with CP and their families who participated in the Move & PLAY study. Children with a diagnosis of CP who were between 17 months to 5 years of age at the beginning of the study were included. The exclusion criteria of Move & PLAY study was children had other primary diagnoses that affected their activity and participation or families did not speak English, French, and Spanish. The families were living in four regions of United States (greater Philadelphia region, Oklahoma, Atlanta, and greater Seattle / Tacoma region) and several regions across Canada. The motor function levels of participants varied across five GMFCS levels. The Move & PLAY study obtained ethics approval from Drexel University and the City of Philadelphia for the greater Philadelphia region as well as other universities in other regions and participating children’s facilities that required their own institutional approval. Parents provided signed informed consent prior to data collection.

All the participants in the Move & PLAY study will be included in Specific Aim 1. Specific Aim 1 will identify the child, family, and environmental determinants of self-determined behaviors of young children with CP. Figure 2 presents the flow chart of subject selection process for Specific Aim 2, which will address the influence of playfulness on self-determined behaviors. For Specific Aim 2, the additional exclusion
criteria are children who have communication or cognition limitations that affect their daily activities fairly great to very great extent. Communication and cognition limitations may have an impact on expression of playfulness of children with CP. To minimize the confounding effect, I decided to add the additional exclusion criteria. The participants will be assigned into two groups based on their GMFCS levels, level I-II and III-V. For each group, the participants will be stratified into 3 age groups (17 to 30 months, 31 to 42 months and 43 months and older) and the quartiles of Test of Playfulness (ToP) scores for each age group will be calculated. In each age group, children whose ToP scores are in the top 25% will be assigned to the playful group and children whose ToP scores are in the bottom 25% will be assigned to less-playful group. There will be 40 children in GMFCS level I-II in each play and less-playful group. There will be 24 children in GMFCS level III-V in each play and less-playful group.
Figure 2 The Flow Chart of Subject Selection in Specific Aim 2

Measures

Table 2 presents the constructs, the measures, and the indicator variables pertaining to Specific Aim 1. Table 3 presents the constructs, the measures, and the indicator variables pertaining to Specific Aim 2.
<table>
<thead>
<tr>
<th>Construct</th>
<th>Name of Measure</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-determined behaviors</td>
<td>Early Coping Inventory</td>
<td>Adaptive Behavior Index (ABI)</td>
</tr>
<tr>
<td><strong>Child Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>Family Information Form</td>
<td>Child’s age</td>
</tr>
<tr>
<td>Gross motor function level</td>
<td>Gross Motor Function Classification System (GMFCS)</td>
<td>GMFCS level (I-V)</td>
</tr>
<tr>
<td>Playfulness</td>
<td>Test of Playfulness</td>
<td>Rasch playfulness score</td>
</tr>
<tr>
<td>Communication problem</td>
<td>Health Conditions for Children with CP</td>
<td>Communication problem and the extent affecting daily life</td>
</tr>
<tr>
<td>Emotion / social problem</td>
<td>Health Conditions for Children with CP</td>
<td>Emotion or behavior problem and the extent affecting daily life</td>
</tr>
<tr>
<td><strong>Family Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family provided opportunity to support their child’s self-determined behaviors</td>
<td>Family Support to Child (FSC)</td>
<td>Average score of item 2 and 6</td>
</tr>
<tr>
<td></td>
<td>Family Expectations of Child (FEC)</td>
<td>Average score of item 2 and 3</td>
</tr>
<tr>
<td></td>
<td>Family Environment Scale (FES)</td>
<td>Sum score of 4 items from the Independence subscale (14, 54, 64, and 84)</td>
</tr>
<tr>
<td>Parent education</td>
<td>Family Information Form</td>
<td>Highest level of education</td>
</tr>
<tr>
<td>Family income</td>
<td>Family Information Form</td>
<td>Total household income level</td>
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<tr>
<td><strong>Environment Variable</strong></td>
<td></td>
<td></td>
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<tr>
<td>Modification</td>
<td>Health Conditions for Children with CP</td>
<td>Home modification (yes/no)</td>
</tr>
<tr>
<td>Assistive technology</td>
<td>Health Conditions for Children with CP</td>
<td>Special equipment used for communication and mobility (See appendix)</td>
</tr>
<tr>
<td>Construct</td>
<td>Name of Measure</td>
<td>Indicator</td>
</tr>
<tr>
<td>-----------</td>
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</tr>
<tr>
<td><strong>Outcome Variable</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-determined behaviors</td>
<td>Early Coping Inventory</td>
<td>Adaptive Behavior Index (ABI)</td>
</tr>
<tr>
<td>Participation</td>
<td>Child Engagement in Daily Life Measure</td>
<td>Average score of participation Average score of enjoyment</td>
</tr>
<tr>
<td><strong>Stratified Grouping Variable</strong></td>
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<td></td>
</tr>
<tr>
<td>Gross motor function level</td>
<td>Gross Motor Function Classification System</td>
<td>GMFCS level</td>
</tr>
<tr>
<td>Age</td>
<td>Family Information Form</td>
<td>Child’s age</td>
</tr>
<tr>
<td>Playfulness</td>
<td>Test of Playfulness</td>
<td>Rasch playfulness score</td>
</tr>
<tr>
<td><strong>Exclusion Criteria</strong></td>
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<td></td>
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<td>Health Conditions for Children with CP</td>
<td>Communication problem and extent affecting daily life</td>
</tr>
<tr>
<td>Cognition</td>
<td>Health Conditions for Children with CP</td>
<td>Cognition problem and extent affecting daily life</td>
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<td><strong>Covariate Variable</strong></td>
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<td>Family Support to Child (FSC)</td>
<td>Average score of item 2 and 6 from FSC and item 2 and 3 from FEC</td>
</tr>
<tr>
<td></td>
<td>Family Expectations of Child (FEC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Family Environment Scale (FES)</td>
<td>Sum score of 4 items from the Independence subscale (14,54, 64, and 84)</td>
</tr>
</tbody>
</table>
Early Coping Inventory

The Early Coping Inventory (Zeitlin, Williamson, & Szczepanski, 1988) is an observation instrument to assess children’s adaptive behavior. Adaptive behavior refers to the behaviors that meet personal needs mentally and physically (Zeitlin & Williamson, 1990; Zeitlin et al., 1988). It is designed for infants and toddlers 4 to 36 months of age or older children with disabilities who function in this developmental age range (Zeitlin et al., 1988). The questionnaire can be completed by parents, caregivers, and teachers based on their familiarity with the child or by others who have observed the child’s behavior. The questionnaire consists of 48 items in three categories: Sensorimotor Organization, Reactive Behaviors, and Self-initiated Behaviors. The items are rated with a 5-point Likert scale, in which 1 indicates that the child’s behaviors are not effective and 5 indicates that the child’s behaviors are consistently effective across situations. The average scores of 16 items are computed in each category. Adaptive behavior index is computed from the average of the 3 categories.

Early Coping Inventory was tested with 405 children with typical development and 1035 children with developmental disability. The average adaptive behavior index of children with typical development was 4.23 and for children with developmental disability it was 3.24 (Zeitlin & Williamson, 1990). Several psychometric validations of
the Early Coping Inventory were reported and indicated that Early Coping Inventory is a reliable and valid measure (Zeitlin et al., 1988). Excellent interrater reliability coefficient ($r_{cc}=.91$) was reported (Zeitlin et al., 1988) with Guilford’s formula (Guilford, 1965). The validity of the overall measure was established (Zeitlin et al., 1988). Factor analysis demonstrated that all 48 items loaded in one factor and explained 50.2% of variance in children with typical development (Zeitlin et al., 1988). For children with developmental disability, four factors emerged explaining 67% of variance (Zeitlin et al., 1988). In the Move & Play database, the Cronbach’s $\alpha$ for the adaptive behavior index was .98, representing excellent internal consistency. In this proposed study, adaptive behavior index will be used to examine the concept of self-determined behaviors in Specific Aim 1 and 2.

*Child Engagement in Daily Life Measure*

The Child Engagement in Daily Life Measure is an observational instrument developed by the Move & PLAY research team. It assesses the construct of child participation and enjoyment in family life and recreational activities, self-care and ease of caregiving. The questionnaire, completed by the parents, consists of four parts: 1) Participation of the child in family and community life and leisure / recreational activity (very often to never), 2) enjoyment of participation (a great deal to not at all), 3) self-care
ability, and 4) ease of caregiving. The questionnaire consists of 30 items and is scored on a 5-point Likert scale.

The test-retest reliability was established with Intra-class Correlation Coefficients (ICC (2,1)). Test-retest reliability was ICC (2,1)=.70 for Participation, .70 for Enjoyment, .96 for Self-Care Ability, and .76 for Ease of Care Giving (Chiarello et al., 2009). For Specific Aim 2, two subscales of Child Engagement in Daily Life Measure, ‘participation in family activities and recreation’ and ‘enjoyment,’ will be used to examine engagement in life tasks, one component of self-determined behaviors. Average participation score is calculated to present the frequency of participation and average enjoyment score is calculated to present the extent of enjoyment.

Test of Playfulness

Test of Playfulness (ToP) is an observational assessment to assess the process and playfulness of children’s play and interaction with playmates or objects (Bundy, 1997, 1998; Bundy et al., 2001). The measure was structured to understand the construct of child’s engagement in play related to enjoyment, responsiveness, provision of appropriate cues, and locus of control (Bundy, 1998). A continuum of playfulness includes the interaction of four elements, which are intrinsic motivation, internal control, freedom to suspend reality, and framing, and refers to the playfulness of a child (Bundy, 1998). The
measure consists of 31 items rated on a 4-point ordinal scale that reflects extent, intensity
or skillfulness of specific behaviors. The playfulness score is obtained through Rasch
analysis. The score in relation to 0 represents the relative playfulness of children. Higher
scores indicate the child is more playful.

The reliability and validity of ToP have been supported with several populations,
such as children with CP, children with traumatic brain injury, and children with sensory
processing dysfunction (Bundy et al., 2001; Hamm, 2006; Harkness & Bundy, 2001;
Okimoto et al., 2000). Bundy tested the validity and reliability of ToP on 141 children
(Bundy et al., 2001). The results showed that 93% of items, 98% of the children, and
100% of the raters conformed to the expectation of the Rasch measurement model.
Further investigation was applied to children with disabilities and 88% of children and
100% of raters conformed to the pattern of playfulness (Bundy et al., 2001). In Specific
Aim 1, the association of playfulness and self-determined behaviors will be examined. In
Specific Aim 2, playfulness score will be used to assign the children into playful and less-
playful group.

_Gross Motor Functional Classification System (GMFCS)_

The GMFCS is a five level system used to classify the motor function level of a
child with CP based on performance in home, school, and community environment
(Palisano et al., 1997). The GMFCS includes 5 levels and 3 age bands (before 2\textsuperscript{nd} birthday, 2\textsuperscript{nd} to 4\textsuperscript{th}, and 4\textsuperscript{th} to 6\textsuperscript{th}) for children with CP who are less than 6 years old. Several studies have supported the reliability and validity of GMFCS. Wood and Rosenbaum reported high inter-rater reliability (G=0.93), and test–retest reliability (G=0.79) (Wood & Rosenbaum, 2000). The content validity was demonstrated by achieving consensus through nominal group process and Delphi survey methods (Palisano et al., 1997; Palisano, Rosenbaum, Bartlett, & Livingston, 2008). In the proposed study, the GMFCS level will be used to define the children’s motor functional level and as a determinant of self-determined behaviors in Specific Aim 1. In Specific Aim 2, GMFCS level is used as a grouping variable to divide the participant into 2 groups, GMFCS level I-II and GMFCS level III-V.

*Health Conditions for Children with CP*

This questionnaire measures the health condition of children with CP and was developed by the Move & PLAY research team. The Health Conditions for Children with CP has two parts, which contains 16 questions in each part: part A Child Health and Medical Procedure; and part B Health Problems. Part A includes the child’s diagnosis, medical procedures, spasticity management, use of assistive device, and environmental modifications. Part B includes 16 health problems, and inquires if the child has the
problems, if treatment is received for these problems, and the extent these problems affect the child’s daily activities. The test-retest reliability of Health Conditions for Children with CP part B was conducted with Intra-class Correlation Coefficients (ICC (2,1)). Test-retest reliability was supported for number (ICC=.80, 95% CI=.63-.90) and average impact (ICC=.85, 95% CI=.72-.93) of the Health Conditions Part B (Bartlett et al., 2009). In Specific Aim 1, the items on communication, cognition and emotion / behavioral status will be used as child determinants of self-determined behaviors and the items on modification to the home and special equipment will be used as environmental determinants.

**Family Expectations of Child and Family Support to Child**

The Family Expectations of Child and Family Support to Child questionnaires are two instruments to assess the extent of family expectation and family support when their children learn to play and do activities themselves. The two questionnaires consist of five and six items, respectively. They are scored on a 7-point Likert scale, from one (not at all) to seven (to a very great extent). The two questionnaires were developed by nine parents of children with CP who were receiving services from one of the centers affiliated with the Ontario Association for Children’s Rehabilitation Services. Good test-retest reliability and content validity were established and demonstrated no difference between two
occasions, two weeks apart (Bartlett et al., 2009). In the proposed study for Specific Aim 1, two individual items in each questionnaire will be selected and the average scores of each 2 items will be used to reflect the concept of opportunity for self-determination provided by family.

*Family Environment Scale (FES)*

The Family Environment Scale (FES) is a tool to measure family functioning (Moos & Moos, 2002). The items reflect three dimensions and 10 subscales of family functioning: 1) relationship (cohesion, expressiveness, and conflict); 2) personal growth (independence, achievement orientation, intellectual-cultural orientation, active-recreational orientation, and moral-religious orientation); 3) system maintenance (organization and control). It consists of 90 items with a dichotomous scale. The reliability and validity were established with internal consistency ranged from .61 to .78 and test-retest reliability ranging from .54 to .91 (Moos and Moos, 2002). Concurrent validity supported that FES is a valid measure of family functioning (Moos & Moos, 2002). In the proposed study for Specific Aim 1, the four out of nine individual items in the independent subscale will be selected and summed to calculate a summary score to reflect the extent to which family members are assertive, self-sufficient and make their own decisions.
**Family Information Form**

Family Information Form is a form collecting the demographic information of the child and the family. Child information includes birthday, gender, and race. Parent information includes age, gender, relationship to the child, education, employment, and income. The child and family information will be used in Specific Aim 1 and Specific Aim 2 to describe the sample as well as for Specific Aim 1 as select child and family determinants of self-determined behaviors.

**Procedures**

The assessors were 60 physical therapists who participated in a training workshop and passed criterion tests prior to the study visit. The assessor therapists were required to complete criterion tests for the Test of Playfulness and the GMFCS. The calibration of Test of Playfulness was carried out with 12 videotapes of 6 children playing indoors and outdoors. The scores completed by the assessors were examined with standard procedures established by the developer of the measure (Bundy et al., 2001). The scores were entered into a normative dataset and checked whether they met the Rasch model expectation. Reliability for the GMFCS was established using a criterion videotape. The assessor therapists classified the GMFCS levels of five the children in the videotape by observing their motor performances and their classifications were compared with criterion levels.
The criterion agreement was 80% or higher. Assessors who did not pass the first time were given additional opportunity to meet criterion for the Test of Playfulness and GMFCS.

The parents received a booklet via mail, which contained five questionnaires and the assessor therapist scheduled a visit. All sessions took place in participants’ homes or health care facilities. The parent completed the booklet, which included Child Engagement in Daily Life Measure, Early Coping Inventory, Family Information Form, and Health Conditions for Children with CP before or during the first study visit. During the visit, the therapists collected the booklet and checked if the parents answered all the questions.

The therapist completed the Test of Playfulness by observing the child playing with the parent for 10 to 20 minutes. The parents were asked to play how they typically play with their child. Parents also were instructed to follow the child’s lead in order to better understand the child’s playfulness. GMFCS level was determined by observing the child’s mobility performance and noting the daily activity performance reported by parents. The total study visit time was two hours, including the other motor and body function assessments administered as part of the Move & PLAY study.
After 6 months, parent completed Family Expectations of Child, Family Support to Child and Family Environment Scale via either phone interview or a paper form and sending to the assessor as the second part of the Move & PLAY study. A trained interviewer called the family and scheduled an appointment with the parent within the window of 5.5 to 6.5 months from the first study visit. The parent received the booklet, including 5 questionnaires, when the interview time was approaching. The interviewer went through every question on the booklet with the parent via the phone. The phone interview time was about an hour.

**Data Analysis**

*Specific Aim 1: Identify Child, Family and Environmental Determinants of Self-Determined Behaviors*

Descriptive statistics for self-determined behaviors and characteristics of child, family and environmental factors will be computed. Structural equation modeling (SEM) will be used to test the conceptual model. Analysis will be performed with the software package AMOS (SPSS, Chicago, IL, USA). SEM is a confirmatory statistical technique to examine the direct and indirect relationships simultaneously among variables and outcomes of interests (DiLalla, 2008). There are two kinds of variables in SEM: latent variables (oval shape) and measured variables (rectangle shape). A latent variable
represents a construct or concept that cannot be measured directly but is inferred from two or more measured variables. In Specific Aim 1, there are 3 latent variables drawn in ovals and 11 measured variables drawn in rectangles for children with CP in GMFCS level I and II (Figure 3). For children with CP in GMFCS level III-V, the construct environmental factor (latent variable) is measured by home modification and assistive technology (measured variables). Figure 4 presents the measurement model for children with CP in GMFCS level III-V.
Figure 3 The Structural Model (Measurement Model and Paths) for Children with CP in GMFCS Levels I-II

Figure 4 The Structural Model (Measurement Model and Paths) for Children with CP in GMFCS Levels III-V
According to Schumacker and Lomax (2004), the three main steps in SEM are model specification, measurement model testing and structural model testing. Model specification involves the selection of reliable and valid indicators and outcome variables for self-determined behaviors. In this process, model specification is based on the theoretical concepts before testing with the data.

The measurement model will be tested with confirmatory factor analysis, which determines how well the measured variables indicate the latent variables. All the measured variables will be tested to determine whether a normal distribution exists before testing the model. Appropriate transformations will be performed if the variables are not normally distributed. The fit of the measurement model will be tested with the magnitude and the significance of the path coefficients between measured variables and latent variables. The measurement model will be modified according to the significance level of the coefficients. Cronbach’s alpha will be used to test the extent to which measured variables for a latent variable hold together. The Cronbach’s alpha of .7 or higher indicates a reliable indication.

The structural model will be tested with two steps. First, the association between variances and covariances will be analyzed with the indices for assessing the model fit, which include goodness to fit index (GFI), comparative fit index (CFI) and the root mean
square error of approximation (RMSEA). The range of GFI and CFI value is between 0 and 1, in which GFI ≥ .90 and CFI ≥ .95 indicates a good fit. The lower the RMSEA value the better the model fit, in which the value ≤ .05 indicates a good fit and ≥ .10 indicates a poor fit. The structural model will be confirmed with two considerations: the significance of path coefficient (p< .01) and the amount of explained variance. The structural model will be re-specified if path coefficients are not significant or the amount of explained variance indicates a poor fit. The process of model re-specification involves eliminating or adding paths or indicators to obtain a better fit of the structural model. Re-specification will be grounded in empirical evidence and the conceptual theory.

Specific Aim 2: the Effects of Playfulness on Self-Determined Behaviors, Participation and Enjoyment

Descriptive statistics of self-determined behaviors, daily participation and enjoyment, and the Test of Playfulness (ToP) scores in playful and less-play groups in each GMFCS level I-II group and GMFCS level III-V group will be computed. Statistical analyses will be performed using the SPSS for Windows software program, version 18.0 (SPSS, Chicago, IL, USA).

Conceptually family provided opportunity to support their child’s self-determined behaviors is proposed to directly influence a child’s self-determined behaviors. Family
provided opportunity is being measured through selected items in Family Expectation of Child, Family Support to Child and Family Environment Scale. There will be 2 covariates taken into consideration including the average score of 2 items in Family Expectation of Child and 2 items in Family Support to Child and the sum score of 4 items in Family Environment Scale. The relationship of the two covariates and self-determined behaviors will be tested for linearity of the covariates. The covariates will be included in the statistical procedure of Specific Aim 2 if \( r > .60 \) (Portney & Watkins, 2009).

The effect of playfulness (more playful/less playful) on self-determined behaviors and participation and enjoyment will be examined with Multivariate Analysis of Variance (MANOVA). The analysis will be performed separately for children in GMFCS I-II and children in GMFCS III-V. According to a significance of MANOVA, for each group, independent t-tests will be conducted for the effect of playfulness on self-determination and participation and enjoyment. An alpha level of .05 for primary statistical tests and .01 for multiple comparisons will be used.

1.5 Limitations

Because the proposal will be examined with a secondary analysis, I will encounter several limitations that will need to be considered when interpreting the findings. First of all, there were no measures designed to assess self-determined behaviors of young
children and family provided opportunity to support their child’s self-determined behaviors. The concept of self-determined behaviors is indirectly inferred with adaptive behavior (Early Coping Inventory) and participation and enjoyment (Child Engagement in Daily Life Measure) of young children with cerebral palsy. In addition, family provided opportunity to support their child’s self-determined behaviors is represented by eight selected items adapted from Family Support to Child (FSC), Family Expectations of Child (FEC) and Family Environment Scale (FES). Although these variables may not be able to demonstrate the whole spectrum of the concept, this project is an important initial step to explore self-determined behaviors of young children and helps to design future study.

Second, environmental factors have been one of my key interests in this proposed study; especially given that the setting has been demonstrated to affect both self-determination and playfulness. However, the Move & PLAY database has limited information related to environmental factors because environment is not a primary interest in the Move & PLAY study. Further research in exploring the environmental component of self-determination model of young children with CP is recommended.

Third, there is small sample size for playful and less-playful groups in children with CP in GMFCS levels III to V. The small sample size decreases the statistical power of the
effects of playfulness on self-determined behaviors for children with CP in GMFCS level III to V. Prior to grouping by high and low playfulness, more children with CP in GMFCS levels IV and V had co-morbidities related to communication and cognition and had to be excluded. There are no children in GMFCS level V in playful group. When investigating the individual dataset, children with GMFCS level V demonstrated playfulness but were not in the top quartile of playfulness score. This may imply the confounding among motor function, playfulness, and self-determined behaviors. The Specific Aim 1 will examine the relationship among these three variables.
### Time Line

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- **Develop and write the proposal**
- **Write the proposal**
- **Defense of proposal**
- **Specific Aim 2: Analyze & Interpret the Results**
- **Finalize the dissertation**
- **Defense of dissertation**
- **Specific Aim 1: Analyze & Interpret the Results**
1.6 References


Budget and Resources

Academic fees:

*Tuition:*
Dissertation credit, 1 credit in Spring 2010: $915
Dissertation credit, 1 credit in Summer 2010: $915
Dissertation credit, 1 credit in Fall 2010: $915
Dissertation credit, 1 credit in Winter 2010: $915
Dissertation credit, 1 credit in Spring 2010: $915
Dissertation credit, 1 credit in Summer 2010: $915

Total tuition = $5,490

*Student fees:*
The university charges: $340 per quarter.
6 quarters x $340.00 = $2040

Total student fees = $2040

Professional expenses

*Professional conference:*
APTA Combined Sections Meeting 2011:
Registration fee (graduate student) = $200.00
Travel to New Orleans = $250.00
Housing (4 nights @ $60/night) = $240.00

AACPDM 64th Annual Meeting:
Registration fee = $470.00
Travel to Washington D.C. = $100.00
Housing = (3 nights @ 60/night) = $180.00

Total professional conference = $1,440

Living expenses

*Health insurance*
International student is required to enroll in Student Health Insurance – Blue Plan.
$1,300 per year x 2 = $2,600

Total health insurance = $2,600

Total expenses

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CHAPTER 2: THE DETERMINANTS OF SELF-DETERMINED BEHAVIORS OF YOUNG CHILDREN WITH CEREBRAL PALSY

Abstract

The purpose of this study was to identify determinants of self-determined behaviors of young children with cerebral palsy (CP). The participants were 429 children with CP (56% boys, 18 to 60 months) and their parents. Structural equation modeling was used to test two models of self-determined behaviors, one for children with walking mobility (Gross Motor Function Classification System, GMFCS levels I-II) and the other for children with limited mobility (GMFCS levels III-V). Cognitive-behavioral function and family provided opportunity to support their child’s self-determined behaviors explained 60% of variance in self-determined behaviors of children with walking mobility. Cognitive-behavioral function, playfulness, and family provided opportunity to support their child’s self-determined behaviors explained 68% of variance in self-determined behaviors of children with limited mobility. The findings indicate that foundational skills, such as cognition, communication, and emotional / behavioral regulation, had a stronger effect on self-determined behaviors than playfulness, a complex attribute that represents a child’s positive attitude and approach toward play. Service providers are encouraged to assess and support children’s daily functioning in cognition, communication, and
emotional / behavioral regulation, playfulness, and family strategies in providing opportunity for children to practice self-determined behaviors.

**Keywords:** Children, Self-Determined Behaviors, Cerebral Palsy, Playfulness
2.1 Introduction

Self-determination is an attribute that describes individuals who take responsibility and advocate for personal life goals (Brotherson, Cook, Erwin, & Weigel, 2008; Shogren & Turnbull, 2006; Ward, 1988; Wehmeyer, 1992, 2001). For example, identifying what one wants, making decisions, solving problems, and actively pursuing interests are behaviors that characterize children who are self-determined (Brotherson et al., 2008; Ward, 1988). Self-determination is considered a desirable outcome of rehabilitation and special education for children with disabilities (Algozzine, Browder, Karvonen, Test, & Wood, 2001; Wehmeyer, 2001) and supported by legislation. The U.S. Department of Education, through the Individuals with Disabilities Education Act (PL 101-476) and the Amendment of the Rehabilitation Act (PL102-569) support self-determination of children, youth, and adults with disabilities:

“Disability is a natural part of the human experience and in no way diminishes the right of individuals to live independently, enjoy self-determination, make choices, contribute to society, pursue meaningful careers and enjoy full inclusion and integration in the economic, political, cultural, and educational mainstream of American society (the Amendment of the Rehabilitation Act, Sec.2(a)(3)(A-F)).”
Children with cerebral palsy (CP) may be at a disadvantage in becoming self-determined compared to their peers without disabilities. Children with CP have a life-long disorder of posture and movement, often accompanied by associated health conditions such as cognition, communication, and behavioral problems that limit their physical ability and daily activities (Rosenbaum et al., 2007). Children with CP have a wide variation of motor ability, which may have an impact on developing self-determination. Research suggests that children with disabilities, including CP, have fewer opportunities to make choices and engage in family activities (Bannerman, Sheldon, Sherman, & Harchik, 1990; Zhang, 2005) and participate in fewer community activities than their peers without disabilities (Ehrmann, Aeschleman, & Svanum, 1995). These differences may have long-term consequences for individuals with CP. Youth with CP demonstrated less participation in recreational and social activities, lower rates of post-secondary education and employment, and more dependence on parents and family compared with youth without disabilities (Andersson & Mattsson, 2001; Wehmeyer, 1996). Two studies, however, reported that adolescents with disabilities who are self-determined achieved better outcomes, such as higher employment rate and better health status, than peers with disabilities who are not self-determined (Wehmeyer, 2003;

**Development of Self-Determined Behaviors in Young Children**

Development of self-determined behaviors is a process of acquiring the skills necessary to foster self-determination. There is a lack of empirical evidence on development of self-determined behaviors. Doll and colleagues (1996) proposed that development of self-determined behaviors begins in infancy (Doll, Sands, Wehmeyer, & Palmer, 1996; Wehmeyer & Palmer, 2000). For example, infants begin to explore and interact with the world through manipulating toys that hold their attention (Brown & Cohen, 1996). Brotherson et al. (2008) proposed that five critical self-determined behaviors in young children are building blocks for self-determination. The five self-determined behaviors are: (1) exhibiting self-awareness; (2) expressing preference and choice; (3) participating in decision making; (4) displaying engagement and persistence; and (5) exercising increased appropriate control over the environment.

Early childhood is considered a sensitive period for the development of self-determined behaviors (Brotherson et al., 2008; Erwin & Brown, 2003; Shogren & Turnbull, 2006). Children at ages 2 to 7 learn to reason, form beliefs, and develop abilities for decision-making and problem-solving (Doll et al., 1996; Piaget, 1983).
Furthermore, during early childhood, young children develop preferences, personal identity, and goal-directed behaviors (Brown & Cohen, 1996).

Family and home environments are considered important supports for the development of self-determined behaviors (Cook, Brotherson, Weigel-Garrey, & Mize, 1996; Erwin & Brown, 2003; Shogren & Turnbull, 2006). Brotherson et al. (2008) conducted a qualitative study that summarized the family reported strategies and home environmental support to enable young children with disabilities to develop self-determined behaviors. For example, parents increase children’s engagement in activities by providing choices and involving children in decision-making and by providing space and home modifications for children to move around (Brotherson et al., 2008). However, there is limited research evidence that supports the impact of family strategies and home environmental support on children’s self-determined behaviors. There is a need for knowledge on how self-determined behaviors are influenced by family and environmental characteristics.

The purpose of this study was to identify child and family characteristics that together are determinants of self-determined behaviors of young children with CP. Two models of self-determined behaviors of children with CP were tested using structural equation modeling (SEM), a confirmatory statistical method that allows to test both the direct and
indirect effects of hypothesized determinants of self-determined behaviors of young children with CP. Knowledge of the determinants of self-determined behaviors in young children will guide families and service providers in supporting children with CP to develop self-determined behaviors.

**Conceptual Model of Determinants of Self-Determined Behaviors in Young Children with CP**

Figure 1 presents our conceptual model of determinants of self-determined behaviors of young children with CP. The model was conceptualized based on appraisal of research and empirical perspectives and discussions among the authors. The model proposes the relationships of direct and indirect paths between the child, family, and environmental characteristics and self-determined behaviors of young children with CP. The direct and indirect paths of the child, family, and environmental characteristics are hypothesized to contribute to self-determined behaviors of young children with CP.
Figure 1 The Conceptual Model of Child, Family, and Environmental Determinants of Self-Determined Behaviors of Young Children with CP
Child Characteristics

Child characteristics are proposed to have a direct effect on and largest contribution to child’s self-determined behaviors. Child characteristics are proposed to represent the child’s capacity related to knowledge, abilities, and perceptions that enable a child to be self-determined. Child characteristics include playfulness, gross motor function, cognitive-behavioral function (cognition, communication, and emotional / behavioral problems) and age.

Playfulness is proposed to be a direct and strongest determinant of self-determined behaviors by virtue of the proposed parallel characteristics of playfulness and self-determined behaviors including motivation, internal locus of control, and engagement (Chang et al., 2012). Playfulness is a behavioral attribute of the individual that is characterized by flexibility, spontaneity, and highly-spirited fun (Bundy, 1997; Hamm, 2006; Hess & Bundy, 2003; Rubin et al., 1983). Bundy (1997) proposed four elements of playfulness: intrinsic motivation, internal control, freedom to suspend reality, and framing. Children who are playful tend to be creative and flexible in solving problems and often demonstrate positive affects (Bundy, 1998). In preschoolers without disabilities, Saunders, Sayer, and Goodale (1999) reported a positive moderate relationship (r=.51, p<.05) between playfulness and adaptive behaviors. Although the result cannot be
generalized to young children with CP, the finding supports proposing playfulness as the strongest determinant of self-determined behaviors for young children with CP.

Gross motor function is proposed to be a direct determinant of self-determined behaviors. Motor limitations of children with CP may impede them perform self-determined behaviors. Gross motor function has been demonstrated as an important predictor of various child outcomes, such as participation and quality of life (Beckung & Hagberg, 2002; Law et al., 2007; Majnemer et al., 2008). However, the impact of physical disability on self-determined behaviors in children with CP has not been identified.

Cognitive-behavioral function (cognition, communication, and emotional / behavioral problems) is proposed to be a direct determinant of self-determined behaviors. Children who have problems learning and understanding may not able to fully comprehend what they need. To our knowledge, the association of cognitive function and self-determined behaviors has not been studied in children. However, Wehmeyer and Palmer (2000) proposed that children with intellectual disability may require additional support to identify their preferences. Performing self-determined behaviors requires the expression of preferences and choices through some means of communication such as gestures and language. Children with disabilities who have difficulties in communicating
their needs may require additional support to express preferences and needs (Erwin & Brown, 2003; Wehmeyer & Palmer, 2000). Children who have problems controlling their emotions or behaviors may not be able to perform self-determined behaviors effectively. One study demonstrated that emotional / behavioral problems contributed to adaptive behavior (β = -.35) in children with CP aged from 3 to 12 years (Chiarello, Almasri, & Palisano, 2009).

Age is proposed to be a direct determinant of self-determined behaviors. Children accumulate and learn from life experiences in various activities as they grow. By virtue of life experiences older children may have more effective self-determined experiences than younger ones. However, for children with CP age has been demonstrated as a less important predictor of several outcomes than motor function ability (Beckung & Hagberg, 2002; Law et al., 2007; Majnemer et al., 2008). Therefore, the effect of age on self-determined behaviors of young children with CP is unknown.

**Family Characteristics**

Family characteristics are proposed to provide opportunities and resources that enable a child to use knowledge and ability to perform self-determined behaviors. Family characteristics include family provided opportunity to support their child’s self-determined behaviors and socioeconomic status (parent education and household income).
Family provided opportunity to support their child’s self-determined behaviors is proposed to have a direct effect as well as an indirect effect via playfulness on self-determined behaviors. Family is the primary and most influential individuals on child’s development, including self-determined behaviors (Brotherson et al., 2008). Family who provide opportunity to support children’s self-determined behaviors may allow children to express preferences, make choices, and engage in family activities. Research evidence has shown that parents of children with disabilities, including CP, provided fewer opportunities for their children to perform self-determined behaviors than parents of children with typical development (Zhang, 2005). However, there is no research evidence on the relationship of the development of children’s self-determined behaviors and family provided opportunity to support self-determined behaviors.

Socioeconomic status is proposed to have an indirect effect via family provided opportunity to self-determined behaviors. Research evidence has shown that families with lower socioeconomic status less frequently encouraged self-determined behaviors for their children with CP than families with higher socioeconomic status (Zhang, 2005).

*Environmental Characteristics*

Environmental characteristics are proposed to have a direct effect on self-determined behaviors. Environmental characteristics are proposed to provide the resources and the
contexts to support children’s self-determined behaviors. Particular for children with limited mobility, we proposed three factors for environmental characteristics that would support children’s self-determined behaviors, i.e., use of communication device, modification to the home, and mobility assistive technology.

Different settings, such as home, school, or community, were suggested to influence children’s ability to perform self-determined behaviors (Wehmeyer, 1999, 2001; Zhang, Wehmeyer, & Chen, 2005). Home is considered the primary place in which children learn and develop self-determined behaviors (Wehmeyer & Palmer, 2000). The accessibility in the home help children with CP learn to access the environment, make choices, and take actions (Erwin et al., 2009). Brotherson et al. (2008) suggested that adaptation of tasks and modification to the home allow children with CP to make choices and actions on their own rather than getting help from the family. Also, for some children with CP, task adaptation using assistive technology enables engagement in life activities, such as self-care or participation in family and community activities. It is important to consider the influence of the environmental characteristics on children’s development of self-determined behaviors. Although the conceptual model includes environmental characteristics, as will be explained in the data analysis section, this study explored only the child and family characteristics.
2.2 Methods

Participants

A convenience sample of 429 children with CP and their families participated in a longitudinal study that examined the determinants of motor abilities, self-care, and play (Bartlett et al., 2010). Children were 18 to 60 months of age at the beginning of the study; their mean age was 38 months. Parents confirmed 98% of children have a diagnosis of CP and therapists reported 8 children exhibited delays in gross motor development and impairments in muscle tone, balance, and postural control but a diagnosis of CP had not been established by the end of the study. Ethics approvals were obtained from participating universities and children service facilities that required their own institutional approval. Parents provided signed informed consent prior to data collection.

The families were living in four regions of United States (greater Philadelphia region, Oklahoma, Atlanta, and greater Seattle and Tacoma region) and nine regions in Canada (St. John’s, Newfoundland; Halifax, Nova Scotia; Hamilton, Peterborough, and Toronto, Ontario; Winnipeg, Manitoba; Regina, Saskatchewan; and Vancouver and Victoria, British Columbia). The caregivers were predominantly mothers with an average of 34 years of age. Seventy three percent of parents of children with walking mobility and
65% of parents of children with limited mobility had some college education or higher. Table 1 presents the demographic information of children with CP and their families.

In this study, children were categorized as having either walking mobility (Gross Motor Function Classification System, GMFCS levels I-II) (Palisano, Rosenbaum, Bartlett, & Livingston, 2008) or limited mobility (GMFCS levels III-V). The decision was made to analyze the determinants of self-determined behaviors on two relatively homogeneous samples separately. Table 2 presents the description of motor ability for five GMFCS levels. In general, by 6 years of age children with walking mobility walk with minimal limitations. By 6 years of age, children with limited mobility use assistive devices in daily activities and need power mobility or are transported in the community.
Table 1 Demographic Information of 429 Children with CP and Their Parents

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<td>Girl</td>
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<td>99 (44)</td>
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<td>V</td>
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<td>97 (43)</td>
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<td>Mother</td>
<td>193 (95)</td>
<td>200 (89)</td>
</tr>
<tr>
<td>Father</td>
<td>7 (3)</td>
<td>14 (6)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (2)</td>
<td>11 (5)</td>
</tr>
<tr>
<td>Parent’s Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school or less</td>
<td>55 (27)</td>
<td>79 (35)</td>
</tr>
<tr>
<td>Community college / associates degree</td>
<td>51 (25)</td>
<td>63 (28)</td>
</tr>
<tr>
<td>Bachelor degree</td>
<td>54 (27)</td>
<td>48 (22)</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>44 (21)</td>
<td>35 (15)</td>
</tr>
<tr>
<td>Parent Employment Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time (30 hours or more per week)</td>
<td>79 (39)</td>
<td>72 (32)</td>
</tr>
<tr>
<td>Part time (less than 30 hours per week)</td>
<td>50 (24)</td>
<td>48 (21)</td>
</tr>
<tr>
<td>Not employed at this time</td>
<td>75 (37)</td>
<td>105 (47)</td>
</tr>
<tr>
<td>Family Income Level^</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than $15,000</td>
<td>18 (9)</td>
<td>23 (10)</td>
</tr>
<tr>
<td>$15,000 - $29,999</td>
<td>17 (8)</td>
<td>29 (14)</td>
</tr>
<tr>
<td>$30,000 - $44,999</td>
<td>21 (11)</td>
<td>33 (15)</td>
</tr>
<tr>
<td>$45,000 - $59,999</td>
<td>27 (14)</td>
<td>32 (15)</td>
</tr>
<tr>
<td>$60,000 - $74,999</td>
<td>25 (13)</td>
<td>24 (11)</td>
</tr>
<tr>
<td>$75,000 or more</td>
<td>89 (45)</td>
<td>75 (35)</td>
</tr>
</tbody>
</table>

*Parent age data available for walking mobility group: n=201; for limited mobility group: n=223

^ Income data available for walking mobility group: n=197; for limited mobility group: n=216
Table 2 Description of the Gross Motor Function Classification System Levels

<table>
<thead>
<tr>
<th>GMFCS Level</th>
<th>2 – 4 Year Age Band</th>
<th>4 – 6 Year Age Band</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking Mobility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Walks alone</td>
<td>Walks indoors and outdoors; climbs stairs</td>
</tr>
<tr>
<td>II</td>
<td>Crawls reciprocally, cruises, walks using assistive mobility devices</td>
<td>Sits on chair arms free; walks without assistive mobility devices; climbs stairs holding railing</td>
</tr>
<tr>
<td>Limited Mobility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Sits on floor, creeps on stomach or crawls, often without reciprocal leg movements; may walk short distances indoors using assistive mobility devices</td>
<td>Sits on chair but may require trunk support to use hands; walks with assistive mobility devices on level surfaces; be transported for long distances or outdoors</td>
</tr>
<tr>
<td>IV</td>
<td>Frequently requires adaptive equipment for sitting and standing; self-mobility for short distances on floor through rolling, creeping or crawling without reciprocal leg movements</td>
<td>Sits with adaptive seating to maximize hand function; may walk short distances with walker and adult supervision but is transported in the community; may achieve self-mobility using a power wheelchair</td>
</tr>
<tr>
<td>V</td>
<td>Limited ability to maintain head and trunk postures; no independent mobility and are transported</td>
<td>Limited ability to maintain head and trunk postures; no independent mobility and are transported</td>
</tr>
</tbody>
</table>
Measures

Structural equation modeling is able to test constructs that are not directly measured (DiLalla, 2008). There are two kinds of variables in SEM: latent variables (represented in figures by an oval shape) and measured variables (rectangle shape). A latent variable represents a construct or concept that cannot be measured directly but is inferred from two or more measured variables.

Self-Determined Behaviors

There are no published standardized measures of self-determined behaviors in young children. In this study, self-determined behaviors were measured by the Early Coping Inventory (Zeitlin, Williamson, & Szczepanski, 1988). The construct of adaptive behavior as measured by the Early Coping Inventory (Zeitlin et al., 1988) is similar to the construct of self-determined behaviors described by Brotherson et al. (2008). Young children perform adaptive behaviors to meet needs in daily life activities, such as self-care, play, socialization, and interaction with peers as well as meet requirements from environments (Zeitlin & Williamson, 1990; Zeitlin et al., 1988). Both adaptive behaviors and self-determined behaviors are related to functioning in daily life to achieve mastery through negotiation and interaction with the environment and people.
The Early Coping Inventory (Zeitlin et al., 1988) is an observation instrument to assess adaptive behavior in children from 4 to 36 months of age or older children with disabilities who function in this developmental age. The questionnaire consists of 48 items in three categories: (1) Sensorimotor Organization, a child’s regulation and response to sensory stimuli (e.g., child reacts to a variety of visual stimuli); (2) Reactive Behaviors, a child’s response to demands of physical and social environment (e.g., child uses behavior appropriate to the situation); and (3) Self-Initiated Behaviors, a child’s action to communicate needs or interact with others (e.g., child initiates interaction with others) (Williamson, Zeitlin, & Szczepanski, 1989; Zeitlin et al., 1988). The questionnaire can be completed by parents, caregivers, and teachers based on their familiarity with the child or by others who have observed the child’s behavior. The items are rated with a 5-point Likert scale, in which 1 indicates that the child’s behaviors are not effective and 5 indicates that the child’s behaviors are consistently effective across situations. The average scores of 16 items are computed in each category. Adaptive behavior index is computed from the average of the three categories. The Early Coping Inventory has evidence of reliability and validity (Zeitlin et al., 1988). In this study, the Adaptive Behavior Index (ABI) was used as an indicator of the measured variable of self-determined behaviors.
**Playfulness**

The Test of Playfulness (ToP) is an observational assessment to assess the process and playfulness of children’s play and interaction with playmates or objects (Bundy, 1997, 1998; Bundy, Nelson, Metzger, & Bingaman, 2001). The measure was structured to understand the construct of child’s engagement in play related to enjoyment, responsiveness, provision of appropriate cues, and locus of control (Bundy, 1998). The measure consists of 31 items rated on a 4-point ordinal scale that reflects extent, intensity, or skillfulness of specific behaviors. “Whether a child actively engaged in activities” is an example of a ToP item. The assessor observes the extent, intensity, and skill of a child’s engagement in games and activities. The playfulness score is obtained through Rasch analysis. The score in relation to 0 represents the relative playfulness of children. Higher scores indicate the child is more playful. The reliability and validity of ToP have been supported for children with developmental delays and disabilities including children with CP (Bundy et al., 2001; Hamm, 2006; Harkness & Bundy, 2001; Okimoto, Bundy, & Hanzlik, 2000).

In this study, 62 physical therapists served as assessors and were required to demonstrate accuracy in scoring the Test of Playfulness. The calibration of the Test of Playfulness was carried out with 12 videotapes of 6 children playing indoors and
outdoors. The scores completed by the assessors were examined with standard procedures established by the developer of the measure (Bundy et al., 2001). The scores were entered into a normative dataset and checked whether they met the Rasch model expectation. In this study, the ToP Rasch score was used as an indicator of the measured variable of playfulness.

_Gross Motor Function Level_

The GMFCS is a five-level system used to classify the gross motor function level of a child with CP based on performance in home, school, and community environments (Palisano et al., 2008). The GMFCS includes 5 levels and 3 age bands (before 2nd birthday, 2nd to 4th, and 4th to 6th) for children with CP who are less than 6 years old. The description of motor ability for the five levels is listed in table 2. In general, children with CP in level I can walk without limitation whereas children with CP in level V are limited in all independent movements. Several studies have supported the reliability and validity of the GMFCS (Palisano et al., 1997; Wood & Rosenbaum, 2000). Wood and Rosenbaum (2000) reported high inter-rater reliability (G=0.93), and test–retest reliability (G=0.79). Content validity was demonstrated by achieving consensus through nominal group process and Delphi survey methods (Palisano et al., 1997). In this study, inter-rater reliability for the GMFCS was established for the assessors using a criterion videotape.
Therapists classified the GMFCS levels of five children in the videotape by observing their motor performances and their classifications were compared with criterion levels. The criterion agreement was 80% or higher. In this study, the GMFCS level was used as an indicator of the measured variable of gross motor function.

*Cognitive-Behavioral Function*

The Health Conditions for Children with Cerebral Palsy is a questionnaire developed by the Move & PLAY research team to measure the health and associated conditions of children with CP (Wong, Bartlett, Chiarello, Chang, & Stoskopf, 2012). It consists of 16 health problems and inquires whether the child has the problems, if treatment is received for these problems, and the extent these problems affect the child’s daily activities. A 7-point Likert scale is used to rate the extent of the problem affected daily activities from one (not at all) to seven (to a very great extent). Test-retest reliability was supported for number of problems (ICC=.80, 95% CI=.63-.90) and average impact (ICC=.85, 95% CI=.72-.93) of the health conditions. In this study, three questions related to the extent of learning and understanding problems, communication problems, and emotional / behavioral problems were used as indicators of the latent construct of cognitive-behavioral function.
Family Provided Opportunity to Support Their Child’s Self-Determined Behaviors

The Family Expectations of Child and Family Support to Child questionnaires assess the extent of family expectation and family support when their children learn to play and do activities themselves. The two questionnaires consist of five and six items, respectively. They are scored on a 7-point Likert scale, from one (not at all) to seven (to a very great extent). The two questionnaires were developed by a consensus process with nine parents of children with CP who were receiving services from one of the centers affiliated with the Ontario Association for Children’s Rehabilitation Services. Content validity and acceptable test-retest reliability were established. There was no difference in responses when the questions were completed a second time two weeks later (Bartlett, Chiarello, & Chang, 2009).

In this study, the latent variable, family provided opportunity to support their child’s self-determined behaviors was represented by three individual items. The three individual items were selected based on the content that matches the concept of encouraging self-determined behaviors. Two items were selected from Family Expectations of Child (i.e., expect to do what he can; expect to try everything) and one was selected from Family Support to Child (i.e., allow taking risk & struggle) questionnaire.
Environmental Characteristics

Child Health and Medical Procedure for Children with Cerebral Palsy questionnaire, developed by the Move & PLAY research team, documents children’s health status and medical history. In this study, a latent variable ‘physical environment’ was identified to represent the construct of environmental characteristics for children with limited mobility. The measured variables were use of communication device, home modification, and mobility assistive technology.

Family Demographic Information

Family demographic information of the children and family was collected with the Family Information Form, a questionnaire developed by the investigators of the Move & PLAY study. Child information includes age and gender. Parent information includes age, relationship to the child, education, employment, and income.

Procedures

The assessors were 62 physical therapists who participated in a training workshop and passed criterion tests prior to data collection. All study visits took place in participants’ homes or health care facilities. The parent completed the Early Coping Inventory, Family Information Form, and Health Conditions for Children with Cerebral Palsy questionnaire before or during the study visit. During the visit, the therapist
collected the measures and checked if the parent answered all the questions. The therapist completed the Test of Playfulness by observing the child playing with the parent for 10 to 20 minutes. The parent was asked to play how they typically play with their child. The parent also was instructed to follow the child’s lead in order to better understand the child’s playfulness. GMFCS level was determined by observing the child’s mobility performance and noting the daily activity performance reported by the parent. The total study visit time was two hours, including the other motor and body function assessments administered as part of the Move & PLAY study.

At a subsequent data collection point, parent completed Family Expectations of Child and Family Support to Child via phone interview, home/clinic visit, or a paper form returned through the mail as the second part of the Move & PLAY study. Families completed these measures on an average of 7.2 months (SD=2.0, ranged from 4.6 to 18.1 months) from the first study visit. Seventy percent of the families completed the measures within 5.5 to 6.5 months from the first study visit. The parent received the booklet, including 5 questionnaires, when the interview time was approaching. The parents completed the interview via the phone or home/clinic visit with the trained interviewers and 45 parents completed via mail. The phone interview time was about an hour, which included the other questionnaires as part of the Move & PLAY study.
Data Analysis

Descriptive statistics for self-determined behaviors and characteristics of child and family factors were computed. Two structural equation models were tested, one for children with walking mobility and the other for children with limited mobility. The analysis was performed with the software package AMOS 18.0 (SPSS, Chicago, IL, USA). The analysis included three processes: model specification, measurement model testing, and structural model testing (Schumacker & Lomax, 2004).

Model specification involves the selection of reliable and valid indicators and outcome variables for self-determined behaviors. In this process, model specification was based on the theoretical concepts before testing with the data. The distribution of scores for all measured variables was tested to ensure the assumption of a normal distribution was met. Cronbach’s alpha was used to determine whether indicators of each latent variable are reliable. The Cronbach’s alpha of .70 or higher was the criterion for reliability. For child and family characteristics, the Cronbach’s alpha values for the latent variables cognitive-behavioral function, family provided opportunity to support their child’s self-determined behaviors, and socioeconomic status were between .69 and .72 for children with walking mobility and between .61 and .71 for children with limited mobility. For environmental characteristics, the ‘physical environment’ latent variable for
children with limited mobility was removed from the model because the Cronbach’s alpha (.06) did not meet the criteria.

The measurement model was tested with a confirmatory factor analysis, which determines how well the measured variables indicate the latent variables. The fit of the measurement model was tested with the magnitude and the significance of the standardized path coefficients between measured variables and latent variables. The measurement model was modified according to the significance level of the coefficients.

Testing the structural model involved analyzing the associations based on variance-covariance matrices. Three indices were used to assess model fit for this study. Goodness to fit index (GFI) estimates how much the model fits compared with no model at all (Kline, 2011). Comparative fit index (CFI) estimates relative improvement fit of a model over a baseline model (Kline, 2011). Root mean square error of approximation (RMSEA) estimates a model fit for the population (Kline, 2011). A good-fit model is indicated by GFI ≥ .90, CFI ≥ .95, and RMSEA ≤ .05. The structural model was confirmed with three considerations: the significance of path coefficient (p<.05), the goodness of fit of three indices, and the amount of explained variance.

Both structural models were re-specified since several standardized path coefficients were not significant and the goodness-to-fit indices indicated a poor fit. The process of
model re-specification involved eliminating or adding paths or indicators to obtain a better fit of the structural model. Re-specification was grounded in AMOS modification indices and conceptualization rationales.

First, the direct paths between child characteristics and self-determined behaviors and between family characteristics and self-determined behaviors were tested. For children with walking mobility, the standardized path coefficients were not significant for the following paths: child age to self-determined behaviors ($\beta=.06$), gross motor function to self-determined behaviors ($\beta=.02$), and socioeconomic status to family provided opportunity ($\beta=.01$). Therefore, child age, socioeconomic status, and the path between gross motor function and self-determined behaviors were removed from the re-specified structural model. The path between playfulness and self-determined behaviors was preserved in the model to reflect the need for further exploration of the association between the constructs. For children with limited mobility, the standardized path coefficients were not significant for the following paths: child age to self-determined behaviors ($\beta=.01$) and socioeconomic status to family provided opportunity ($\beta=.01$). Therefore, child age and socioeconomic status were removed from the re-specified structural model. The path coefficient between gross motor function and self-determined behaviors was significant in the initial model for children with limited mobility. However,
the path coefficient became insignificant during the process of model re-specification. The path was removed from the re-specified structural model to improve the fit of the model.

2.3 Results

In the model for children with CP with walking mobility, the indices indicated a good fit between the covariance matrix for the data and covariance matrix predicted by the structural model (NFI=.92; CFI=.97; RMSEA=.05, 90% CI = .00 to .08). Figure 2 presents the re-specified model for children with CP with walking mobility. The model explained 60% of the variance in self-determined behaviors. The standardized path coefficients were significant (p<.05) for direct paths between cognitive-behavioral function (β=-.66), family provided opportunity (β=.26), and self-determined behaviors. The path between self-determined behaviors and playfulness (β=-.13) was not significant; nonetheless, the path was preserved (dash line in figure 2). Cognitive-behavioral function (β=-.49) and GMFCS level (β=-.22) explained 29% of variance in playfulness.

For the model for children with CP with limited mobility, the indices indicated a good fit between the covariance matrix for the data and covariance matrix predicted by the structural model (NFI=.96; CFI=.99; RMSEA=.04, 90% CI = .00 to .07). Figure 3 presents the re-specified model for children with CP with limited mobility. The model
explained 68% of the variance in self-determined behaviors. The standardized path coefficients were significant (p<.05) for direct paths between cognitive-behavioral function (β =-.54), playfulness (β=.29), family provided opportunity (β =.16) and self-determined behaviors. Cognitive-behavioral function (β=-.47) and GMFCS level (β =-.28) explained 41% of variance in playfulness. Family provided opportunity (β =-.39) explained 15% of variance in cognitive-behavioral function.
*Dash line: insignificant path coefficient

**Figure 2 The Re-Specified Structural Equation Model for Children with CP with Walking Mobility (GMFCS Levels I-II)**
Figure 3 The Re-Specified Structural Equation Model for Children with CP with Limited Mobility (GMFCS Levels III-V)
2.4 Discussion

The structural models indicate that self-determined behaviors of children with CP aged from 18 to 60 months were influenced by multiple child and family characteristics. The respecified model of determinants for children with walking mobility explained 60% of the variance of self-determined behaviors and the respecified model of determinants for children with limited mobility explained 68% of variance of self-determined behaviors. The explained variance suggests that both models are good predictors of the outcome (Cohen, 1992; Kline, 2011). The findings support previous studies that self-determined behaviors of children with CP are influenced by learning, communication, and emotional / behavioral problems (Chiarello et al., 2009) as well as family provided opportunity to support children’s self-determined behaviors (Brotherson et al., 2008; Zhang, 2005).

Cognitive-behavioral function is the primary indicator of self-determined behaviors of both children with CP with walking mobility and limited mobility. Children with less cognition, communication, and emotional / behavioral problems that affected function in daily life had more effective self-determined behaviors. Our finding is consistent with previous studies that reported an association between self-determined behaviors and associated health conditions, such as cognition, communication, and behavioral problems.
in children with CP (Chiarello et al., 2009; Zeitlin & Williamson, 1990). Self-determined behaviors are children taking an active role in knowing their needs, making choices based on their preferences, making decisions, and interacting with others. Children’s learning and understanding, speaking or communicating with others, and controlling emotions or behaviors are necessary to enable children to effectively perform self-determined behaviors.

For children with CP, the structural relationship in this study provides a comprehensive understanding of the association between playfulness and self-determination. Our hypothesis that playfulness is a primary determinant of self-determined behaviors was not supported for children with walking mobility. Previously, Saunders and colleagues (1999) reported a univariate relationship of adaptive behavior and playfulness in preschooler without disabilities. We did find a moderate univariate relationship between playfulness and self-determined behaviors (r=.48, p<.01), which was consistent with the results by Saunders et al. (1999). However, when together accounting for other indicators, playfulness was not a significant contributor of self-determined behaviors for children with CP with walking mobility. Our result indicates that the self-determined behaviors of children with CP may be more affected by foundational skills, such as cognition, communication, and emotional / behavioral
regulation rather than playfulness, a multidimensional attribute that represents a child’s positive attitude and approach toward play.

For children with CP with limited mobility, playfulness was an indicator of self-determined behaviors. Children with limited mobility who are more playful had more effective self-determined behaviors. We believe that this is an important finding that children with more severe motor activity limitations who are more playful may be able to discover strategies to utilize assistance to make choices or solve problems despite their physical limitations. Service providers and parents can support children’s playfulness by encouraging children’s motivation, allowing children the freedom to try things in creative ways, and enhancing verbal and non-verbal social interactions between children and others. In addition, the influence of cognitive-behavioral function and gross motor function to self-determined behaviors were mediated by playfulness. The results suggested that playfulness might be influenced by cognitive-behavioral function and/or gross motor function. Children with less cognitive-behavioral function problems and/or higher gross motor function were more playful and more self-determined. Therefore, service providers are encouraged to improve children’s motor ability, learning and understanding, communication, and controlling emotions and behaviors to support
playfulness of young children with limited mobility and to enhance their self-determined behaviors.

The findings on family characteristics were consistent with previous studies reporting that the effectiveness of self-determined behaviors was influenced by family support and provided opportunity to children (Brotherson et al., 2008; Zhang, 2005). Family provided opportunity for their children to perform self-determined behaviors is an indicator for both children with walking mobility and limited mobility. Brotherson (2008) indicated that families used a variety of strategies to create opportunity for their children to perform self-determined behaviors based on their children’s level of disabilities and conditions. As an example, parents made the dresser drawers easy to be opened so their children were able to choose what they want to wear without assistance (Brotherson et al., 2008). Therefore, parents are encouraged to provide opportunities for their children to try things, make choices, and learn from their experiences and struggles to enhance self-determined behaviors of their children with CP. Service providers, with their expertise in task analysis and adaptations, are encouraged to assist families to identify strategies and create opportunities to support children’s self-determined behaviors.
Limitation of the study

There are several limitations to consider when interpreting the results. First, the construct of adaptive behavior (Early Coping Inventory) does not fully encompass all aspects of self-determined behaviors of young children. The Early Coping Inventory addresses the self-determined behaviors of self-awareness, decision-making, engagement and persistence, and appropriate control over the environment. The measure includes a range of items that reflect these behaviors. For the behavior of expressing preference and choice the measure only has limited items that capture this behavior. Some sophisticated form of behavior is not captured, such as a child expresses preference and choice that is appropriate to social situations.

Second, the playfulness score in this study was obtained via a 10 to 20-minute observation of the children with CP playing with their parents. A one-time observation might not fully capture the children’s playfulness.

Third, one qualitative study summarized adaptation of tasks and modification to the home and indicated the importance of environmental characteristics to self-determined behaviors of children with disabilities (Brotherson et al., 2008). However, the Move & PLAY study was not originally designed to examine broader environmental characteristics beyond the family. In this current study we were unable to identify
sufficient and valid information to examine environmental characteristics. Future research is recommended to understand the association of environmental variables to self-determined behaviors of children with CP, particularly for children with limited mobility, such as the assistive technology that allows children to access resources and participate in activities, accessibility of environmental settings, and accommodations of the environments.

Fourth, in this study we chose to explore the determinants of self-determined behaviors and the contributions of child and family characteristics to self-determined behaviors. We do not know if there is a reciprocal relationship that self-determined behaviors contribute to the development of child and family characteristics.

Conclusions

The two structural models support cognition, communication, emotional / behavioral regulation, and family provided opportunity to support their child’s self-determined behaviors as determinants of self-determined behaviors of young children with CP. Service providers are encouraged to assess and support children’s daily functioning in learning and understanding, communicating, controlling emotions and behaviors, and family strategies to enhancing self-determined behaviors. For children with CP with limited mobility, supporting playfulness can be an important strategy in enhancing self-
determined behaviors. Children who are self-determined are involved in their life, interact with objects and people, and engage in daily activities. Therefore, it is important that service providers appreciate the multi-dimensional nature of self-determination, support the child from a holistic perspective including mobility and playfulness, and value the importance of team collaboration to enhance children’s self-determined behaviors.
2.5 References


CHAPTER 3: EFFECTS OF PLAYFULNESS ON SELF-DETERMINED BEHAVIORS AND PARTICIPATION IN YOUNG CHILDREN WITH CEREBRAL PALSY

Abstract

This study examined the effect of playfulness on self-determined behaviors and frequency and enjoyment of participation in family life and recreational activities for children with cerebral palsy grouped by gross motor function. One hundred twenty-seven children (18-60 months, 57% boys) were categorized as having walking mobility (more playful group, n=40; less playful group, n=39) or limited mobility (more playful group, n=24; less playful group, n=24). Among children with walking mobility, those who are more playful had more effective self-determined behaviors than children who are less playful (p<.02). Among children with limited mobility, those who are more playful had greater enjoyment of participation in family life and recreational activities than children who are less playful (p<.01). Service providers are encouraged to enhance children’s playfulness to promote self-determined behaviors and enjoyment of participation for children with cerebral palsy.

Keywords: Playfulness, Self-Determination, Participation, Enjoyment, Cerebral Palsy
3.1 Introduction

Self-determined behaviors and participation have been proposed as important outcomes for children with cerebral palsy (CP) in the service delivery of health care and education (Kline, 2011; Palisano et al., 2011). Children with CP due to their limitations in mobility and manipulation may be at a disadvantage in becoming self-determined and participating in family life and recreational activities compared to their peers without disabilities. Play is young children’s primary avenue to become involved in everyday life activities. Playful children are creative and flexible in play and demonstrate positive affects (Bundy, 2005). In this study, we propose that playfulness fosters young children’s self-determined behaviors and participation as they grow and develop during childhood.

Participation, Self-Determined Behaviors, and Cerebral Palsy

The International Classification of Functioning, Disability, and Health for Children and Youth (ICF-CY) defines participation as involvement in life situations, which includes rights to self-determination and involvement in family life and recreational activities (Perenboom & Chorus, 2003; World Health Organization, 2007). Self-determination is an attribute that is used to describe individuals who take responsibility and advocate for their personal life goals (Brotherson, Cook, Erwin, & Weigel, 2008; Shogren & Turnbull, 2006; Ward, 1988; Wehmeyer, 1992, 2001). Identifying what one
wants, making decisions, solving problems, and actively pursuing interests are examples of behaviors that characterize children who are self-determined (Brotherson et al., 2008; Ward, 1988). For young children, participation in family life and recreational activities is thought to enable children to acquire knowledge, learn skills, develop friendships, and gain physical and social competences (M. Law, 2002) and, consequently, develop self-determined behaviors. Through participation in family life and recreational activities, children obtain a variety of opportunities to develop self-determined behaviors. Conversely, children who are self-determined actively involve themselves in family life and recreational activities that interest them.

The need to optimize self-determined behaviors and participation is supported by research on social interactions and outcomes in youth with disabilities, including CP. Cerebral palsy is a life-long disorder of posture and movement, often accompanied by associated health conditions, such as cognition, communication, and behavioral problems, that limits physical ability and daily activities (Rosenbaum et al., 2007). Children with CP have widely varying motor abilities, which may have an impact on becoming self-determined and participating in daily life activities. Research suggests that children with disabilities, including CP, have fewer opportunities to make choices and engage in family activities (Bannerman, Sheldon, Sherman, & Harchik, 1990; Zhang, 2005) and participate
in fewer community activities than their peers without disabilities (Ehrmann, Aeschleman, & Svanum, 1995). These differences may have long-term consequences for individuals with CP. Youth with CP demonstrated less participation in recreational and social activities, lower rates of post-secondary education and employment, and more dependence on parents and family compared with youth without disabilities (Andersson & Mattsson, 2001; Ward, 1988). Two studies, however, reported that adolescents with disabilities who are more self-determined achieved better outcomes than peers with disabilities who are less self-determined, such as higher employment rate and better health status (Wehmeyer et al., 2003; Wehmeyer & Schwartz, 1997). Therefore, supporting self-determined behaviors and participation of children with CP may be critical for optimal life experiences.

**Development of Self-Determined Behaviors in Young Children**

Development of self-determined behaviors is a process of acquiring the skills necessary to foster self-determination. There is a lack of empirical evidence on development of self-determined behaviors. Doll and colleagues (1996) proposed that development of self-determination begins in infancy (Doll, Sands, Wehmeyer, & Palmer, 1996; Wehmeyer & Palmer, 2000). For example, infants begin to explore and interact with the world through manipulating toys that hold their attention (Brown & Cohen,
Brotherson (2008) proposed that five critical self-determined behaviors in young children are building blocks for self-determination (Brotherson et al., 2008). The five self-determined behaviors are: (1) exhibiting self-awareness; (2) expressing preference and choice; (3) participating in decision making; (4) displaying engagement and persistence; and (5) exercising increased appropriate control over the environment. Early childhood is considered a sensitive period for the development of self-determined behaviors (Brotherson et al., 2008; Erwin & Brown, 2003; Shogren & Turnbull, 2006) since children from ages 2 to 7 years are learning to reason, forming beliefs, and developing abilities for decision-making and problem-solving (Doll et al., 1996; Piaget, 1983). Through various processes of exploration in early childhood, young children develop preferences, personal identity, and goal-directed behaviors (Brown & Cohen, 1996).

Engagement and persistence are considered the most important components of self-determined behaviors (Brown & Cohen, 1996). Engagement refers to sustained attention to activities in an appropriate and meaningful way (Brotherson et al., 2008). The Self-Determination Theory (SDT) proposed by Deci and Ryan (2000a, 2000b) hypothesizes that individuals have innate psychological needs of mastering personal behaviors (autonomy), engaging with activities (competence), and making connections with others
(relatedness). Engaging in physical and social environments is important for self-determined behaviors. A child’s level of competence in interacting with everyday life activities is related to the extent of engagement in the tasks (Deci & Ryan, 2000a, 2000b; Poulsen, Rodger, & Ziviani, 2006). When a child performs a task with competence, he or she is more likely to persist and engage in tasks and be successful (Poulsen et al., 2006).

Playfulness

Playfulness is a behavioral attribute of an individual characterized by flexibility, spontaneity, and highly-spirited fun (Bundy, 1997; Hamm, 2006; Hess & Bundy, 2003; Rubin, Fein, & Vandenberg, 1983). Playfulness is the approach to play regardless of the type of play activity (Bundy, 1997; Hamm, 2006; Hess & Bundy, 2003; Rubin et al., 1983). Bundy (1997) proposed four elements of playfulness: intrinsic motivation, internal control, freedom to suspend reality, and framing. Intrinsic motivation refers to having self-interests, initiating action, and involvement in activity. Internal control reflects a child’s belief that he or she is responsible for his or her behavior. Freedom to suspend reality connotes that a child is not restricted to what is real, shows creativity such as pretend or imaginary play, and has fun by “breaking the rules,” such as playful mischief. Framing describes reading cues of others, responding to others, and maintaining the engagement of a play structure when interacting with others (Bundy, 1997, 2005). In
general, as children develop they display more playfulness as some aspects of playfulness have a cognitive component. For example, two-year old children are able to appreciate humor, as one expression of playfulness (Bergen, 2006). Preschoolers learn how to use humor to have fun from their experiences and interaction with others (Bergen, 2006). Research on whether children with disabilities are as playful as their peers without disability is inconclusive, but suggests that children with physical disabilities (2 to 12 years old), including CP, may display more playfulness with environmental support (Harkness & Bundy, 2001; Rigby & Gaik, 2007). Research on the influence of playfulness on participation as well as on self-determined behaviors in children with CP has not been explored. As play is primary way that children learn and develop functional behaviors, there is need for research on how playfulness contributes to children’s participation and self-determined behaviors.

The Model of Self-Determined Behaviors and Playfulness

Figure 1 presents the conceptual model illustrating the relationship between self-determined behaviors and playfulness. Since there are no published measures of self-determined behaviors in young children, we believe that adaptive behavior reflects the concepts of self-determined behaviors. Conceptually, adaptive behavior describes the process whereby a child modifies his or her behavior to meet needs in daily life activities
in self-care, play, and socialization and to manage interactions with the environment. This description of adaptive behavior matches the five critical self-determined behaviors. That is, both adaptive behavior and self-determined behaviors are related to functioning in daily life to achieve mastery through negotiation and interaction with the environment and people. The relationship of playfulness and adaptive behavior has been reported in preschoolers and in adolescents with behavioral disorders and their peers without disabilities (Hess & Bundy, 2003; Saunders, Sayer, & Goodale, 1999). Saunders, Sayer, and Goodale (1999) demonstrated a positive moderate relationship between playfulness and adaptive behavior in preschool children without disabilities ($r=.51, p<.05$). Hess and Bundy (2003) found a positive strong relationship between playfulness and adaptive behavior in adolescents with severe behavioral disorders and adolescents without disabilities ($r=.79, p<.05$). These results cannot be generalized to young children with CP; however, they support the need for research to determine the relationship between playfulness and self-determined behaviors.
Figure 1 Proposed Parallel Characteristics Between Self-Determined Behaviors and Playfulness

Components of Self-determination
1. Self-awareness
2. Preference and choice
3. Decision making
4. Engagement and persistence
5. Appropriate control

Components of Playfulness
1. Intrinsic motivation
2. Internal control
3. Freedom to suspend reality
4. Framing

Parallel Characteristics
1. Motivation
2. Internal locus of control
3. Engagement
We proposed that self-determined behaviors and playfulness share three parallel characteristics, i.e., motivation, internal locus of control, and engagement. Motivation involves interaction and interrelationship of self-awareness, persistence in action, and competence to fulfill one’s human needs (Deci & Ryan, 2000a; Poulsen et al., 2006). An internal drive to take action is central to self-determination. In young children, intrinsic motivation is inherent in child’s play (Bundy, 1997). Children’s play is often motivated by their own curiosity and interest in an activity that is enjoyed without the need for external rewards.

Internal locus of control is related to making choices and decisions, solving problems, and learning from experiences to achieve perceived control in one’s life (Wehmeyer, 1999). Internal locus of control is evidenced by a sense of competence to achieve the outcome (Grolnick, Gurland, & Jacob, 2002). For playfulness, internal locus of control refers to a child directing a play activity and having the abilities to do what he or she wants to do in the play. A child with internal locus of control decides what and how to play and carries out play in the way he or she wants.

Engagement is related to continuously interacting and being involved in activities or with a group of people (Witmer & Singer, 1998). People who are engaged in activities become involved in the activities in a meaningful fashion. For playfulness, the term
'framing’ is used to describe the ability of a child to perceive, select, and respond to verbal and non-verbal communication in order to interact with peers and structure a play activity (Bateson, 1973; Bundy, 2005). Giving and reading social cues and maintaining a play theme are examples of framing (Bundy, 2005).

Other Factors that Potentially Influence Self-Determined Behaviors and Participation

Self-determined behaviors and participation are complex constructs that may be influenced by multiple factors other than playfulness. We believe it is important to account for children’s developmental and functional abilities. The readiness to perform self-determined behaviors is associated with age-related developmental skills, which include motor ability, cognition, and communication (Brotherson et al., 2008; L. A. Chiarello, Almasri, & Palisano, 2009; Erwin & Brown, 2003; Wehmeyer, 2001). We believe that the motor activity limitations may impede children with CP from being self-determined. Previous study demonstrated that children with significant mobility limitations have less effective adaptive behavior than children with less motor limitations (L. A. Chiarello, Almasri, et al., 2009). Cognition has been demonstrated as a factor of self-determined behaviors in youth with intellectual disabilities (Wehmeyer, 1996, 1999; Wehmeyer & Schwartz, 1997). Wehmeyer and Palmer (2000) reported that adolescents with more significant intellectual disability required additional support to identify their
preferences as compared to adolescents with less intellectual disability. Self-determined behaviors require the expression of preferences and choices through some means of communication, such as gestures and language. Chiarello et al. (2009) reported moderate negative correlations between adaptive behavior and communication problems (r=-.39, p<.001) and learning problems (r=-.43, p<.001) for children with CP.

Motor activity, cognition, and communication have also been demonstrated as important predictors of participation (Beckung & Hagberg, 2002; Mary Law et al., 2007; Majnemer et al., 2008). Adaptive behavior, mobility function, and upper extremity and physical function have been found to explain 46% of the variance of the intensity of participation in family life and recreational activities of preschoolers with CP (L.A. Chiarello et al., 2012). Ostensjo et al. (2003) reported that learning problems explained 9% of variance in social functioning in young children with CP. Cognition and communication have been reported as indicators for participation of children with CP ages from 6 to 14 years (King et al., 2006; Shikako-Thomas, Majnemer, Law, & Lach, 2008).

The purpose of this study was to explore the effect of playfulness on self-determined behaviors, frequency of participation, and enjoyment of participation in young children with CP with walking mobility (Gross Motor Function Classification System, GMFCS
levels I-II) (Palisano, Rosenbaum, Bartlett, & Livingston, 2008) and with limited mobility (GMFCS levels III-V). We examined the following hypotheses: Children who are more playful demonstrate more effective self-determined behaviors in daily life; children who are more playful have higher frequency of participation in family life and recreational activities; and children who are more playful have greater enjoyment of participation in family life and recreational activities than children who are less playful.

3.2 Methods

Participants

One hundred and twenty-seven children with CP (m=39 months, SD=12, 57% boys) participated in this study. The participants were drawn from a sample of 430 children with CP who participated in the Move & PLAY longitudinal study on the determinants of motor abilities, self-care, and play (Bartlett et al., 2010). Table 1 describes the demographic information for children with CP and their parents, presented separately for children with walking mobility and children with limited mobility. Parents confirmed 98% of children have a diagnosis of CP and therapists reported 3 children exhibited delays in gross motor development and impairments in muscle tone, balance, and postural control but a diagnosis of CP had not been established by the end of the study. The motor
function levels of the children varied across five GMFCS levels from 59 children in level I to 13 children to level V.

The families were living in four regions of United States (greater Philadelphia region, Oklahoma, Atlanta, and the greater Seattle and Tacoma region) and nine regions in Canada (St. John’s, Newfoundland; Halifax, Nova Scotia; Peterborough and Toronto, Ontario; Winnipeg, Manitoba; Regina, Saskatchewan; and Vancouver, British Columbia). The caregivers were predominantly mothers (94%) or fathers (5%) with an average of 35 (SD = 7) years of age, and are referred to as parents in this paper. Sixty-eight percent of the parents had at least some level of college education. Ethics approvals were obtained from participating universities and children’s service facilities that had their own institutional approval. Parents provided signed informed consent.
| Table 1 Demographic Information of 127 Children with CP and Their Parents |
|-----------------------------|-----------------------------|-----------------------------|
|                            | Walking Mobility N = 79 (%) | Limited Mobility N = 48 (%) | Total N = 127 (%) |
| **Child Age Group**         |                            |                            |                  |
| 17 to 30 months             | 20 (25) | 12 (25) | 32 (25) |
| 31 to 42 months             | 26 (33) | 14 (29) | 40 (32) |
| 43 months & older           | 33 (42) | 22 (46) | 55 (43) |
| **Child Gender**            |                            |                            |                  |
| Boy                         | 44 (56) | 29 (60) | 73 (57) |
| Girl                        | 35 (44) | 19 (40) | 54 (43) |
| **Child GMFCS level**       |                            |                            |                  |
| Walk without limitations (level I) | 59 (75) | 59 (45) |           |
| Walk with limitations (level II) | 20 (25) | 20 (15) |           |
| Walk with hand-held mobility device (level III) | 19 (40) | 19 (15) |           |
| Self-mobility with limitations (level IV) | 16 (33) | 16 (13) |           |
| Limited in independent movement (level V) | 13 (27) | 13 (10) |           |
| **Parent Relationship to the Child** |                            |                            |                  |
| Mother                      | 76 (96) | 43 (90) | 119 (94) |
| Father                      | 3 (4)   | 3 (6)   | 6 (5)    |
| Grandmother                 | 0 (0)   | 2 (4)   | 2 (1)    |
| **Parent Education**        |                            |                            |                  |
| Less than high school       | 1 (1)   | 2 (4)   | 3 (2)    |
| High school OR GED          | 19 (24) | 19 (40) | 38 (30)  |
| Bachelors degree or community college | 45 (57) | 20 (41) | 65 (51)  |
| Graduate degree             | 14 (18) | 7 (15)  | 21 (17)  |
| **Household Income (n=125)** |                            |                            |                  |
| Less than $15,000           | 4 (5)   | 5 (11)  | 9 (7)    |
| $15,000 - $29,999           | 7 (9)   | 6 (13)  | 13 (11)  |
| $30,000 - $44,999           | 9 (11)  | 11 (23) | 20 (16)  |
| $45,000 - $59,999           | 10 (13) | 9 (19)  | 19 (15)  |
| $60,000 - $74,999           | 14 (18) | 4 (8)   | 18 (14)  |
| $75,000 or more             | 34 (44) | 12 (26) | 46 (37)  |
Among the 430 children in the Move & PLAY study, 250 children with CP and their families were eligible for this study and 180 children with CP were excluded based on communication or cognition limitations that affect their daily activities fairly great to very great extent. The exclusion criteria were added to minimize the potential confounding effect that communication and cognition limitations may have on self-determined behaviors. Figure 2 presents the flow chart of subject selection process. The 250 eligible children were assigned to one of two categories based on their GMFCS levels, i.e., walking mobility (GMFCS levels I-II) and limited mobility (GMFCS levels III-V). Preliminary work demonstrated that children with CP with more severe mobility limitations display lower levels of playfulness than children with some mobility functions (Chiarello & Chang, 2010). In addition we were interested in characterizing the effect of playfulness among children with CP who use limited mobility. Therefore, the decision was made to analyze the effect of playfulness on self-determined behaviors, frequency of participation, and enjoyment of participation on two relatively homogeneous samples separately, i.e., children with walking mobility and children with limited mobility.
Our preliminary work demonstrated that children with CP who are 43 months and older expressed their playfulness better than children who are 17 to 30 months old (Chiarello & Chang, 2010). Therefore, age was used in the stratification process to minimize the confounding effect of age. The participants were divided into three age bands, 17 to 30 months old, 31 to 42 months old, and 43 to 60 months old. The age bands were selected to distribute children into three relatively equal groups. In each age band,
the quartiles of Test of Playfulness (ToP) scores were calculated. Children whose ToP scores were in the top 25% were assigned to the more playful group and children whose ToP scores were in the bottom 25% were assigned to the less playful group. Children whose ToP scores were in the middle 50% (n=122) were not included in this study. There were 80 children with walking mobility, 40 in each more playful and less playful groups. The less playful group dropped to 39 children due to one child not completing the outcome measures. There were 48 children with limited mobility, 24 in each more playful and less playful group.

Chi-square test and Mann-Whitney U tests were used to determine whether children who are more playful and less playful, within each mobility category, differed on GMFCS level, cognition problems, and communication problems. Children with limited mobility who are less playful differed in their GMFCS levels compared with children who are more playful (z=21.9, p<.001). Specifically, 13 children in GMFCS level V were in the less playful group whereas no children in GMFCS level V were in the more playful group. Table 2 presents the cognition problems and communication problems for children with walking and limited mobility. Children with walking mobility who are less playful had cognition problems (z=-2.6, p<.01) and communication problems (z=-2.6, p<.01) that affected their life to a greater extent than children who are more playful. Children with
limited mobility who are less playful had cognition problems ($z=-3.5$, $p<.001$) and communication problems ($z=-4.0$, $p<.001$) that affected their life to a greater extent than children who are more playful.

Table 2 Parents’ Responses to Whether Their Children with Cerebral Palsy Have A Cognitive Problem and/or Communication Problem by Children’s Playfulness and Mobility (%)

<table>
<thead>
<tr>
<th></th>
<th>Walking Mobility (GMFCS levels I-II)</th>
<th>Limited Mobility (GMFCS levels III-V)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More Playful n=40</td>
<td>Less Playful n=39</td>
</tr>
<tr>
<td><strong>Extent of Cognition Problem</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does not have problem</td>
<td>38 (94)</td>
<td>28 (71)</td>
</tr>
<tr>
<td>Have problem, does not affect daily life activity at all</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Have problem, affects daily life activity to a very small extent</td>
<td>0 (0)</td>
<td>1 (3)</td>
</tr>
<tr>
<td>Have problem, affects daily life activity to a small extent</td>
<td>1 (3)</td>
<td>7 (18)</td>
</tr>
<tr>
<td>Have problem, affects daily life activity to a moderate extent</td>
<td>1 (3)</td>
<td>2 (5)</td>
</tr>
</tbody>
</table>

| **Extent of Communication Problem** |                                      |                                       |
| Does not have problem | 30 (74)                              | 20 (51)                              | 20 (84)           | 6 (25) |
| Have problem, does not affect daily life activity at all | 3 (8) | 1 (3) | 1 (4) | 0 (0) |
| Have problem, affects daily life activity to a very small extent | 2 (5) | 0 (0) | 0 (0) | 2 (8) |
| Have problem, affects daily life activity to a small extent | 2 (5) | 3 (8) | 1 (4) | 4 (17) |
| Have problem, affects daily life activity to a moderate extent | 3 (8) | 15 (38) | 2 (8) | 12 (50) |
Measures

*Early Coping Inventory*

The construct of adaptive behavior, as measured by the Early Coping Inventory (Zeitlin, Williamson, & Szczepanski, 1988), is similar to the construct of self-determined behaviors described by Brotherson et al. (2008). For young children, we believe that adaptive behavior reflects the concepts of self-determined behaviors; therefore, in this study adaptive behavior as measured by the Early Coping Inventory was used as the measure of self-determined behaviors.

The Early Coping Inventory (Zeitlin et al., 1988) is an observation instrument to assess children’s adaptive behavior from 4 to 36 months of age or older children with disabilities who function in this developmental age. Young children perform adaptive behaviors to meet needs in daily life activities, such as self-care, play, socialization, and interaction with peers as well as meeting requirements from environmental settings (Zeitlin & Williamson, 1990; Zeitlin et al., 1988). The questionnaire consists of 48 items in three categories: (1) Sensorimotor Organization, a child’s regulation and response to sensory stimuli (e.g., child reacts to a variety of visual stimuli); (2) Reactive Behaviors, a child’s response to demands of physical and social environment (e.g., child uses behavior appropriate to the situation); and (3) Self-Initiated Behaviors, a child’s action to
communicate needs or interact with others (e.g., child initiates interaction with others) (Williamson, Zeitlin, & Szczepanski, 1989; Zeitlin et al., 1988). The questionnaire can be completed by parents, caregivers, and teachers based on their familiarity with the child or by others who have observed the child’s behavior. The items are rated with a 5-point Likert scale, in which 1 indicates that the child’s behaviors are not effective and 5 indicates that the child’s behaviors are consistently effective across situations. The average scores of 16 items are computed in each category. Adaptive behavior index (ABI) is computed from the average of the 3 categories. Several psychometric validations of the Early Coping Inventory were reported and indicated that Early Coping Inventory is a reliable and valid measure (Zeitlin et al., 1988). In this study, the ABI is used as an indicator of self-determined behaviors.

*Child Engagement in Daily Life Measure*

The Child Engagement in Daily Life Measure is an observational instrument developed by the Move & PLAY research team. It assesses the construct of a child’s frequency of participation and enjoyment of participation in family life and recreational activities and self-care and ease of caregiving in family routines. The questionnaire, completed by the parents, consists of four parts: (1) frequency of participation of the child in family and community life and leisure / recreational activity (very often to never),
(2) enjoyment of participation (a great deal to not at all), (3) self-care ability, and (4) ease of caregiving. The questionnaire consists of 30 items and is scored on a 5-point Likert scale. The test-retest reliability was supported (participation, ICC=.70, 95% CI=.47-.84; enjoyment, ICC=.70, 95% CI=.47-.84) (Chiarello, Chang, & the Move & PLAY team, 2009). In this study, two subscales, ‘frequency of participation of the child in family and community life and leisure / recreational activity’ and ‘enjoyment of participation,’ were used to examine engagement in life tasks. Average scores were calculated to present the frequency of participation and the enjoyment of participation.

*Test of Playfulness*

Test of Playfulness (ToP) is an observational assessment to assess the process and playfulness of children’s play and interaction with playmates or objects (Bundy, 1997, 2005; Bundy, Nelson, Metzger, & Bingaman, 2001). The measure was structured to understand the construct of child’s engagement in play related to enjoyment, responsiveness, provision of appropriate cues, and locus of control (Bundy, 2005). The measure consists of 31 items rated on a 4-point ordinal scale that reflects extent, intensity or skillfulness of specific behaviors. “Whether a child actively engaged in activities” is an example of ToP item. The assessor observes the extent, intensity, and skill of a child’s engagement in games and activities. The playfulness score is obtained through Rasch
analysis. The score in relation to 0 represents the relative playfulness of children. Higher scores indicate the child is more playful. The reliability and validity of ToP have been supported for children with developmental delays and disabilities including children with CP (Bundy et al., 2001; Hamm, 2006; Harkness & Bundy, 2001; Okimoto, Bundy, & Hanzlik, 2000).

In this study, 62 physical therapists who served as assessors were required to demonstrate accuracy in scoring the Test of Playfulness. The calibration of Test of Playfulness was carried out with 12 videotapes of 6 children playing indoors and outdoors. The scores completed by the assessors were examined with standard procedures established by the developer of the measure (Bundy et al., 2001). The ToP scores were entered into a normative dataset and checked whether they met the Rasch model expectation.

*Gross Motor Function Classification System (GMFCS)*

The GMFCS is a five level system used to classify the motor function level of a child with CP based on performance in home, school, and community environments (Palisano et al., 2008). The GMFCS includes five levels and three age bands (before 2\textsuperscript{nd} birthday, 2\textsuperscript{nd} to 4\textsuperscript{th}, and 4\textsuperscript{th} to 6\textsuperscript{th}) for children with CP who are less than 6 years old. In general, children with CP in level I can walk without limitation whereas children with CP
in level V are limited in all independent movements. Several studies have supported the reliability and validity of GMFCS (Palisano et al., 1997; Wood & Rosenbaum, 2000). Wood and Rosenbaum (2000) reported high inter-rater reliability (G=0.93), and test–retest reliability (G=0.79). Content validity was demonstrated by achieving consensus through nominal group process and Delphi survey methods (Palisano et al., 1997).

In this study, inter-rater reliability for the GMFCS was established for the assessors using a criterion videotape. Therapists classified the GMFCS levels of five the children in the videotape by observing their motor performances and their classifications were compared with criterion levels. The criterion agreement was 80% or higher.

Health Conditions of Children with Cerebral Palsy

The Move & PLAY research team developed a questionnaire to measure the health conditions of children with CP (Wong, Bartlett, Chiarello, Chang, & Stoskopf, 2012). It consists of 16 health problems and inquires whether the child has the problems, if treatment is received for these problems, and the extent these problems affect the child’s daily activities. A 7-point Likert scale was used to rate the extent that the problem affected daily activities from one (not at all) to seven (to a very great extent). Test-retest reliability was supported for number of problems (ICC=.80, 95% CI=.63-.90) and average impact (ICC=.85, 95% CI=.72-.93) of the health conditions (Wong et al., 2012).
**Family Information Questionnaire**

A questionnaire was developed by the investigators of the Move & PLAY study to collect demographic information on the child and the family. Child information includes age and gender. Caregiver information includes age, gender, relationship to the child, education, employment, and income.

**Procedure**

The assessors were 62 physical therapists who participated in a training workshop and passed criterion tests prior to data collection. All study visits took place in participants’ homes or health care facilities. The parent completed the Child Engagement in Daily Life Measure, Early Coping Inventory, Family Information Form, and Health Conditions for Children with CP questionnaire before or during the study visit. During the visit, the therapist collected the measures and checked if the parents answered all the questions.

The therapist completed the ToP by observing the child playing with the parent for 10 to 20 minutes. The parents were asked to play how they typically play with their child. Parents also were instructed to follow the child’s lead in order to better understand the child’s playfulness. GMFCS level was determined by observing the child’s mobility performance and noting the daily activity performance reported by parents. The total
study visit time was two hours, including the other motor and body function assessments administered as part of the Move & PLAY study.

Data Analysis

Statistical analyses were performed using the SPSS for Windows software program, version 18.0 (SPSS, Chicago, IL, USA). Descriptive statistics of ABI, frequency and enjoyment of participation, and ToP scores in the more playful and less playful groups were computed. GMFCS level, extent of cognition problems, and extent of communication problems were hypothesized to possibly confound an understanding of the effects of playfulness on self-determined behaviors, frequency of participation, and enjoyment of participation. The Spearman correlation coefficient was used to determine the potential covariates’ relationships with the three dependent variables. There were no to moderate relationships (r = .0 to -.55) between the three covariate variables and self-determined behaviors, frequency of participation, and enjoyment of participation (Table 3). The covariates were selected based on the following criteria: 1) the coefficient was .25 and higher; 2) and the correlation coefficient was statistically significant.

Analysis of Covariance (ANCOVA) was used to examine the effect of playfulness on: 1) ABI of children with walking mobility; 2) enjoyment of participation in children with walking mobility; 3) ABI of children with limited mobility; and 4) frequency of
participation of children with limited mobility. The covariates for each dependent variable are as follows: 1) for ABI of children with walking mobility, extent of cognition problems and extent of communication problems were used as covariates; 2) for enjoyment of participation of children with walking mobility, extent of cognition problems was used as covariate; 3) for ABI of children with limited mobility, GMFCS level, extent of cognition problems, and extent of communication problems were used as covariates; and 4) for frequency of participation of children with limited mobility, extent of communication problems was used as covariates. Mann-Whitney U test was used to examine the effects of playfulness on: 1) frequency of participation of children with walking mobility, and 2) enjoyment of participation of children with limited mobility because both dependent variables were not associated with the covariates. The effect size was calculated for the individual effects for any significant results. Alpha level of .02 was used for all analyses to account for testing three dependent variables separately.
Table 3 Spearman Correlation Coefficients between Potential Covariates and Outcome Variables for Children with Cerebral Palsy Grouped by Method of Mobility

<table>
<thead>
<tr>
<th>Group</th>
<th>Dependent variables</th>
<th>GMFCS level</th>
<th>Cognition</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children with Walking Mobility</strong></td>
<td>ABI</td>
<td>-.20</td>
<td>-.38*</td>
<td>-.27*</td>
</tr>
<tr>
<td></td>
<td>Frequency of Participation</td>
<td>-.003</td>
<td>-.15</td>
<td>-.17</td>
</tr>
<tr>
<td></td>
<td>Enjoyment of Participation</td>
<td>-.19</td>
<td>-.26*</td>
<td>-.22</td>
</tr>
<tr>
<td><strong>Children with Limited Mobility</strong></td>
<td>ABI</td>
<td>-.64**</td>
<td>-.53**</td>
<td>-.55**</td>
</tr>
<tr>
<td></td>
<td>Frequency of Participation</td>
<td>-.08</td>
<td>-.03</td>
<td>-.34*</td>
</tr>
<tr>
<td></td>
<td>Enjoyment of Participation</td>
<td>-.19</td>
<td>-.07</td>
<td>-.28</td>
</tr>
</tbody>
</table>

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

3.3 Results

Figure 3 presents the distribution of ToP scores between more playful and less playful groups for children with walking mobility and with limited mobility. The mean ToP score for children with walking mobility who are more playful was 1.92 (SD=.47), which indicated that on average children who are more playful display almost all playful behaviors on the measure. The mean ToP score for children with walking mobility who are less playful was -0.04 (SD=.58), which indicated that on average children who are less playful display at least half of playful behaviors on the measure. The mean ToP score
for children with limited mobility who are more playful was 1.64 (SD=.96), which indicated that on average children who are more playful display majority of playful behaviors on the measure. The mean ToP score for children with limited mobility who are less playful was -0.85 (SD=.65), which indicated that on average children who are less playful display a limited amount of playful behaviors on the measure.

Figure 3 Boxplots of the Test of Playfulness Scores for Children with Cerebral Palsy in the Top 25% (More Playful) and Bottom 25% (Less Playful) Grouped by Method of Mobility
Table 4 presents the scores of ABI, frequency of participation, and enjoyment of participation for the more playful and less playful groups. Among children with walking mobility, the mean ABI score was 4.5 (SD=0.4) for those who are more playful and 4.2 (SD=0.6) for those who are less playful, both scores within the range of behaviors being ‘effective more often than not.’ Children who are more playful had more effective self-determined behaviors compared with children who are less playful (F=5.79, df=1, p<.02).

The effect size for the ANCOVA test is f = .36, which indicates a large effect. Children with walking mobility who are more playful (m=3.9, SD=0.5) and who are less playful (m=3.8, SD=0.6) participated in family life and recreational activities ‘often.’ Children with walking mobility who are more playful enjoyed their participation in family life and recreational activities from ‘very much’ to ‘a great deal’ (m=4.5, SD=0.4) and those who are less playful ‘very much’ (m=4.3, SD=0.6). Frequency and enjoyment of participation in family life and recreational activities did not differ statistically between children with walking mobility in the more playful and the less playful groups.
Among children with limited mobility, the mean ABI score was 4.5 (SD=0.3) for children who are more playful, behaviors ‘effective more often than not’ and 3.6 (SD=0.6) for children who are less playful, behaviors ‘situationally effective, with some generalization of behaviors.’ Children with limited mobility who are more playful participated in family life and recreational activities ‘often’ (m=3.7, SD=0.6) and those who are less playful from ‘once in a while’ to ‘often’ (m=3.4, SD=0.5). There is no statistically significant difference for ABI score and frequency of participation in family life and recreational activities between children with limited mobility who are more playful and who are less playful. Children with limited mobility who are more playful enjoyed their participation in family life and recreational activities from ‘very much’ to ‘a great deal’ (m=4.4, SD=0.6) and those who are less playful enjoyed ‘very much’ (m=3.9,
SD=0.7). Children who are more playful had greater enjoyment of participation in family life and recreational activities compared with children who are less playful \((z=-2.70, p<.01)\). The effect size for the Mann-Whitney U test is \(r = .39\), which indicates a medium effect.

### 3.4 Discussion

The findings of this study advance the knowledge of the effect of playfulness on self-determined behaviors and participation in family life and recreational activities in young children with CP. Our study design that divided children with CP based on motor function allowed us to explore the effect of playfulness on the outcomes for children who walk and for those who have limited mobility separately. The hypotheses of the study were partially supported. For the outcomes of self-determined behaviors and enjoyment of participation, the findings were different for comparisons between children who walk and comparisons between children who have limited mobility. These findings suggest that playfulness may have a differential effect on self-determined behaviors and enjoyment of participation, depending on motor function. For the outcome of frequency of participation, the findings were the same for comparisons between children who walk and comparisons between children who have limited mobility. This study supports the value of playful interactions to promote children’s active role in daily life, such as
making decisions, communicating needs with others, and pursuing their interests and
goals. Early intervention service providers are encouraged to broaden their service
delivery from a prime focus on promoting children developmental skills and competence
to also focus on supporting playfulness to promote self-determined behaviors and
participation in family life and recreational activities.

Self-Determined Behaviors

Our finding that children with CP who walk and are more playful had more effective
self-determined behaviors than children who are less playful suggests that while children
who walk have adequate skills and motor abilities to explore the world and develop
effective self-determined behaviors, children who are less playful may require additional
support to learn and develop self-determined behaviors. For children with CP who walk,
self-determined behaviors scores in both the more playful and less playful groups are
clinically interpreted as ‘effective more often than not’ even though there was a
statistically significant difference between the groups. The ‘effective more often than not’
score indicates that children are able to perform or adjust their behavior appropriately for
most daily activities. Children may occasionally have challenges in some activities or
situations; nevertheless, they have effective skills and abilities to adapt to the demands of
most conditions. Although clinical interpretation of the results seem not to support the
difference between children who are more playful and those who are less playful, children who are less playful had a larger variability of self-determined behaviors than children who are more playful. The scores for self-determined behaviors of children who are less playful ranged from ‘situationally effective’ to ‘consistently effective across situations’ compared to those of children who are more playful which ranged from ‘effective more often than not’ to ‘consistently effective across situations.’

For children with CP with limited mobility, self-determined behaviors of children who are more playful was ‘effective more often than not’ compared to children who are less playful where self-determined behaviors were ‘situationally effective, with some generalization of behaviors,’ a clinically important difference but not a statistical difference. The ‘situationally effective, with some generalization of behaviors’ score indicates children are able to use self-determined behaviors in particular environmental contexts. For example, children may demonstrate less effective behaviors when they feel the situation is unfamiliar, uncomfortable, or unsafe. ANCOVA was performed in order to diminish the impact of three covariates (gross motor ability, extent of cognition problem, and extent of communication problem). With a small sample size, controlling for three covariates and a stringent alpha level of .02, the result approached significance
(p=.03). This provides evidence that the finding warrants further study in examining the effect of playfulness on self-determined behaviors of young children with CP.

The results of this study support the assumption of the conceptual model of the parallel characteristics between playfulness and self-determined behaviors. Barnett (1998) suggested that children who are playful are active, creative, flexible, sociable, and engaged. Children who are more playful may have greater curiosity to drive them to explore the environment spontaneously. Without any external rewards, children like to explore the world and seek activities that interest them. Through play, children engage in activities or games; have experiences in problem-solving and decision-making; obtain a sense of competence and responsibility; and interact with peers by reading and giving cues and establishing social relationships. These characteristics of playfulness exemplify the components of self-determined behaviors. Therefore, playfulness is potentially an avenue to develop self-determined behaviors in young children. Further study is needed to examine the mechanism of playfulness to self-determined behaviors.

**Frequency of Participation in Family Life and Recreational Activities**

Our finding that there is no statistically significant difference on frequency of participation between children with CP with limited mobility who are less playful and children who are more playful suggests that other factors might be more predominant
than their playfulness. Children with limited mobility who are less playful participated in family life and recreational activities ‘once in a while’ to ‘often’ whereas children with limited mobility who are more playful participated in family life and recreational activities ‘often,’ indicating a clinically important difference. ANCOVA was performed to account for the impact of effect of communication problems in daily life and the result demonstrated no differences. Communication is listed as one of the potential child factors contributing to children’s recreational participation (King et al., 2006; World Health Organization, 2007). An explanation for the clinical difference of frequency of participation in children with limited mobility is the influence of communication problems. Shikako-Thomas (2009) systematically reviewed publications related to recreational participation of children with CP and indicated that recreational participation of children with CP was influenced by multi-dimensional (child, family, and environment) factors. Although personality trait is one of the child factors for participation of children with CP (Shikako-Thomas et al., 2008), playfulness as one of the important personality traits in children did not show an effect on participation in this study. This implies that participation is a broad and complex construct and one needs to consider the effects from multiple domains.

**Enjoyment of Participation in Family Life and Recreational Activities**
Children with CP with limited mobility who are more playful have enjoyment of participation in family and recreational activity from ‘very much to ‘a great deal’ where those are less playful ‘very much,’ a difference that is statistically significant and clinically important. Playfulness is an attribute describing a child’s tendency to be flexible, spontaneous, and enthusiastic (Bundy, 2003) whereas enjoyment refers to how much children like activities. Children who are more playful show more positive affect during an activity, such as laughing, giggling, or singing, indicating enjoyment. As they get satisfaction from the enjoyment in participation, children become more engaged. Therefore, the cycle could be viewed as a beneficial experience that by helping children engage in an activity in a playful way will help them enjoy participation more. This study demonstrated that although children with limited mobility experience limited participation via physical movements, their playfulness potentially leads them to enjoy participation.

Limitation

There are several limitations to consider when interpreting the results. First, the results are only applied to children who are more playful and less playful and without cognition and communication problems greatly affecting their daily life activities. We chose to study the children with the extremes of the most and the least playfulness in
comparing their self-determined behaviors and frequency and enjoyment of participation in family and recreational activities. We do not know what amount of playfulness is needed to have a meaningful impact on those outcomes for children with CP and their family.

Second, the data collection was not prospectively designed to answer the research questions of this study. The construct of self-determined behaviors is indirectly inferred with adaptive behavior for young children with CP. The construct of adaptive behavior as measure by the Early Coping Inventory does not fully encompass all aspects of self-determined behaviors of young children with CP. The Early Coping Inventory addresses the self-determined behaviors of self-awareness, decision-making, engagement and persistence, and appropriate control over the environment. The measure includes a range of items that reflect these behaviors. For the behavior expressing preference and choice, the measure has limited items that capture this behavior. More sophisticated forms of the behavior are not captured, such as a child expressing preference and choice that is appropriate to social situations.

Third, there is a smaller sample size for the more playful and less playful groups in children with CP with limited mobility. Even though the participants were drawn from a large study, which included 225 children with CP with limited mobility, most children
were excluded due to the associated health conditions, such as extent of cognition problems and communication problems. A relative small sample size in ANCOVA analysis might result in insignificant results.

Fourth, the playfulness score in this study was obtained via a 10 to 20-minute observation of the children with CP playing with their parents. As research showed that playfulness was influenced by external factors and environmental support (Brentall, Bundy, & Kay, 2008; Bronson & Bundy, 2001; Rigby & Gaik, 2007), a one-time observation might not fully capture the children’s playfulness.

Implication for Practitioners

This study provides preliminary evidence that playfulnes enhances self-determined behaviors and enjoyment of participation for young children with CP. Playfulness may have an important role in promoting self-determined behaviors for children with limited mobility. Notably, children with limited mobility who are more playful have similar scores of self-determined behaviors to children who walk and are more playful. This implies that children with limited mobility who are more playful may be able to find their way to overcome the physical limitation or utilize assistance to make choices or solve problems. Service providers and parents can support children’s playfulness by encouraging children’s motivation, allowing children the freedom to try things in creative
ways, and enhancing verbal and non-verbal social interactions between children and others. Early intervention service providers are encouraged to support playfulness for young children with CP in various environmental settings. Especially for children with CP with limited mobility, supporting playfulness during early intervention visits could be an effective avenue to help them overcome their activity limitations and learn effective self-determined behaviors. Early intervention service providers are encouraged to balance directing therapeutic sessions with enabling children to take the lead in playing and doing tasks.

**Conclusion**

This study is a first step to understanding the effect of playfulness on self-determined behaviors, frequency of participation, and enjoyment of participation in young children with CP. The results indicate that children with CP who walk and are more playful have more effective self-determined behaviors and children with CP with limited mobility who are more playful have greater enjoyment of participation in family and recreational activities than children who are less playful. Future research is recommended to explore the activities that support playfulness then subsequently examine the influence of children’s playfulness on the development of self-determined behaviors and participation in family life and recreational activities for young children.
with CP. Future research is also recommended to design a measure that is specific to and
fully addresses all dimensions of young children’s self-determined behaviors.
3.5 References


CHAPTER 4: SUMMARY

Self-determined behaviors refer to children taking an active role in knowing their needs, making choices based on their preferences, solving problems, making decisions, and interacting with others. The purpose of this dissertation was to gain knowledge of the self-determined behaviors of children with cerebral palsy (CP). This knowledge is important for identifying the strategies in the process of service delivery that supports self-determined behaviors of children with CP. The objective of Study I was to identify child and family characteristics that together are determinants of self-determined behaviors of children with CP. The objectives of Study II were to determine the differences in self-determined behaviors, frequency of participation, and enjoyment of participation between children with CP who are more playful and less playful.

Study I – Determinants of Self-Determined Behaviors

Participants and Measures

The participants in Study I were 429 children with CP (18 to 60 months, 56% boys) and their parents. The participants participated in the Move & PLAY study, which was a prospective longitudinal study that examined the determinants of motor abilities, self-care, and play of young children with CP (Bartlett et al., 2010). The dependent variable for Study I was self-determined behaviors, measured by the Early Coping Inventory (Zeitlin,
Williamson, & Szczepanski, 1988). The Early Coping Inventory was used as an indicator of self-determined behaviors, based on the perspective that adaptive behavior reflects the concepts of self-determined behaviors. The independent variables of the study included the child and family characteristics. The child characteristics were: 1) playfulness, measured by the Test of Playfulness (ToP) (Bundy, 2005); 2) gross motor function level, measured by the Gross Motor Function Classification System (GMFCS) (Palisano, Rosenbaum, Bartlett, & Livingston, 2008); 3) cognitive-behavioral function, measured by Health Conditions for Children with Cerebral Palsy (Wong, Bartlett, Chiarello, Chang, & Stoskopf, 2012); and 4) child age, collected by a family information form. The family characteristics were: 1) Family provided opportunity to support their child’s self-determined behaviors, measured by Family Expectation of Child (Bartlett, Chiarello, & Chang, 2009) and Family Support to Child (Bartlett et al., 2009); and 2) socioeconomic status, collected by a family information form. Structural equation modeling was used to test two models of self-determined behaviors, one for children with walking mobility (GMFCS levels I-II) and the other for children with limited mobility (GMFCS levels III-V). Structural equation modeling is a confirmatory statistical method that allows testing both the direct and indirect effects of hypothesized determinants of self-determined behaviors of young children with CP.
For **Study I**, two modifications to the research proposal were made. First, the measured variables which indicate the latent variable ‘family provided opportunity to support their child’s self-determined behaviors’ were changed because the internal consistency of the original measured variables did not meet the criteria. The original measured variables were four items from Family Environment Scale, two items from Family Expectation of Child, and two items from Family Support to Child. Four items from Family Environment Scale and one item from Family Support to Child were removed from the model because the internal consistency did not meet the criteria and the constructs were not specific to family provided opportunity to support their child’s self-determined behaviors. The final measured variables were two items from Family Expectation of Child (i.e., expect to do what he can; expect to try everything) and one item from Family Support to Child (i.e., allow taking risk & struggle) because these variables more specifically reflect the construct of family provided opportunity to support their child’s self-determined behaviors. The Cronbach’s alphas for the measured variables were .69 for children with walking mobility and .71 for children with limited mobility.
Second, the latent variable ‘physical environment’ was removed from the model because the internal consistency of the original measured variables did not meet the criteria. The original measured variables were use of communication device, home modification, and mobility assistive technology. Use of communication device and home modification variables were removed from the model because the internal consistency did not meet the criteria and the constructs were not specific to physical environment that supports a child’s self-determined behaviors. Mobility assistive technology variable was removed from the model because the mobility assistive technology data was collected one year after the dependent variable (Early Coping Inventory).

The necessity for these modifications provided a valuable lesson in measurement methodology for secondary data analysis: the importance of the validation process for variables that are categorized differently from the original study. For instance, because the Move & PLAY study was not designed to examine environmental characteristics, it was challenging to identify reliable variables for this construct as conceptualized in my model of determinants of self-determined behaviors. Even though mobility assistive technology is relevant to environmental characteristics, the variable was disqualified after considering the timing in data collection. Therefore, when conceptualizing and selecting the measured variables, not only is a series of validation processes via statistical methods
required but also careful consideration and identification of the data structure in order to make sure the variables are valid for the aims of the secondary analysis.

Results

The structural model indicated that for children with walking mobility two significant direct factors, cognitive-behavioral function and family provided opportunity to support their child’s self-determined behaviors, explained 60% of variance in self-determined behaviors. For children with limited mobility, three significant direct factors, cognitive-behavioral function, playfulness, and family provided opportunity to support their child’s self-determined behaviors, explained 68% of variance in self-determined behaviors. Collectively, the models indicated that the children with CP who had less cognition, communication, and emotional/behavioral problems that affected function in daily life had more effective self-determined behaviors. Children who have limited mobility and are more playful had more effective self-determined behaviors. Children with CP whose family provided children more opportunity to try things and to take risk and struggle had more effective self-determined behaviors. The unexplained variance of self-determined behaviors in both structural models indicates that additional determinants may be required which were not included in the model, such as environmental characteristics.
Study II – The Effect of Playfulness on Self-Determined Behaviors, Frequency of Participation, and Enjoyment of Participation

Participants and Measures

The participants in Study II were 127 children with CP (18 to 60 months, 57% boys) who were categorized as having walking mobility (GMFCS levels I-II, more playful group, n=40; less playful group, n=39) or limited mobility (GMFCS levels III-V, more playful group, n=24; less playful group, n=24). Exclusion criteria were children who have communication or cognition problems that affect their daily life from a ‘fairly great’ to ‘very great extent’ extent. Children in the more playful and less playful groups for each mobility category were assigned with a stratification method. Children in the Move & PLAY database who remained after the exclusion criteria were categorized by gross motor function (GMFCS levels I-II and levels III-V) and then stratified by age (17 to 30 months, 31 to 42 months, and 43 to 60 months) to minimize the confounding effects of both. In each age group, children whose ToP scores were in the top 25% were assigned to the more playful group and children whose ToP scores were in the bottom 25% were assigned to the less playful group.

The dependent variables for Study II were self-determined behaviors, measured by the Early Coping Inventory (Zeitlin et al., 1988), and frequency of participation and
enjoyment of participation, measured by Child Engagement in Daily Life Measure (Chiarello, Chang, & the Move & PLAY team, 2009). The independent variable was playfulness, measured by the Test of Playfulness (Bundy, 2005). The covariate variables were gross motor function level, measured by the Gross Motor Function Classification System (GMFCS) (Palisano et al., 2008), and extent of communication problem and extent of cognition problem, measured by Health Conditions for Children with Cerebral Palsy (Wong et al., 2012).

Modifications to the Research Proposal

For **Study II**, two modifications to the research proposal were made. First, the covariate variables were changed from family variables (family provided opportunity to support their child’s self-determined behaviors) to child variables (cognition problem, communication problem, and gross motor function level) because the research interest was to understand the effect of playfulness on self-determined behaviors, frequency of participation, and enjoyment of participation by controlling for child characteristics. Although exclusion criteria and stratification process were used, there were still differences in cognition problem, communication problem, and gross motor function level between the more playful and less playful groups. Also, cognition problem, communication problem, and gross motor function level were significantly associated
with at least one of the three outcome variables. Therefore, instead of MANOVA, the dependent variables were analyzed separately with either ANCOVA or Mann-Whitney U test, depending on the identification of appropriate covariates. The criteria for selecting the covariates were changed from Spearman correlation coefficients between the covariates and dependent variables $r > .60$ to $r > .25$ to account for the confounding effects. Also a more stringent alpha level (.02) was used to account for testing three dependent variables separately.

**Results**

Among children with walking mobility, those who are more playful had more effective self-determined behaviors than children who are less playful. Among children with limited mobility, those who are more playful had greater enjoyment of participation in family life and recreational activities than children who are less playful. There was no difference on the amount of participation among children with walking mobility and among children with limited mobility.

**Summary of Dissertation Research**

The findings in **Study I** support cognitive-behavioral function (cognition, communication, emotional / behavioral regulations) and family provided opportunity to support their child’s self-determined behaviors as determinants of self-determined
behaviors of children with CP. For playfulness, the findings support the conceptual model of three parallel characteristics (motivation, internal locus of control, and engagement) between playfulness and self-determined behaviors. In Study I playfulness was a determinant for children with limited mobility. Although the structural relationship indicated that playfulness was not a determinant for children with walking mobility, in Study II children who walk and are more playful had more effective self-determined behaviors compared to children who are less playful. The findings indicate that the relationship of playfulness and self-determined behaviors was influenced by other child and family characteristics. Therefore, children’s learning and understanding, communication, controlling emotions and behaviors, playfulness, mobility, and family provided opportunity for their child to try things and learn from experiences are important considerations to support self-determined behaviors of children with CP.

Implications for Practice

The findings of this dissertation research have implications for practice for promoting self-determined behaviors and enjoyment of participation for young children with CP. Service providers are encouraged to assess and support children’s daily functioning in cognition, communication, and emotion / behavior regulations to enhance self-determined behaviors. It is important to assist families to identify opportunities and
strategies during daily activities and playtime to support their children to be playful and self-determined. Service providers and parents can support children’s playfulness by encouraging their motivation, allowing children the freedom to solve problems and accomplish tasks in creative ways, and enhancing verbal and non-verbal social interactions between children and others. Service providers are also encouraged to balance directing therapeutic sessions with enabling children to take the lead in doing tasks. Children who are self-determined are involved in their life, display positive affects, interact with objects and people, and engage in daily activities. Therefore, it is important that service providers appreciate the multi-dimensional nature of self-determination, support the child from a holistic perspective including mobility and playfulness, and value the importance of team collaboration to enhance children’s self-determined behaviors.

Limitations and Future Research

There were several limitations in my dissertation research. First, the construct of adaptive behavior (Early Coping Inventory) does not fully encompass all aspects of self-determined behaviors of young children. The Early Coping Inventory addresses the self-determined behaviors of self-awareness, decision-making, engagement and persistence, and appropriate control over the environment. The measure includes a range of items that
reflect these behaviors. For the behavior of expressing preference and choice the measure only has limited items that capture this behavior. Some sophisticated form of behavior is not captured, such as a child expresses preference and choice that is appropriate to social situation. Second, the playfulness score in this study was obtained via a 10 to 20-minute observation of the children with CP playing with their parents. A one-time observation might not fully capture the children’s playfulness. Third, the conceptual model of self-determined behaviors of children with CP includes environmental characteristics. However, I was unable to identify reliable and valid indicators from the Move & PLAY database to include in my analysis.

Future research is recommended to: 1) identify the activities that support playfulness; 2) longitudinally examine the influence of children’s playfulness on the development of self-determined behaviors and participation in family life and recreational activities for young children with CP; 3) design a measure that is specific to and fully addresses all dimensions of young children’s self-determined behaviors; and 4) examine the association of environmental characteristics such as accessibility of environmental settings, accommodations of the environments, or environmental resources to self-determined behaviors of children with CP, particularly for children with limited mobility.
References


### APPENDIX 1: PARALLEL BETWEEN SELF-DETERMINED BEHAVIOR AND ADAPTIVE BEHAVIOR

<table>
<thead>
<tr>
<th>Building Block</th>
<th>Item in Early Coping Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self-awareness</strong></td>
<td>9. Child demonstrates pleasure in self-initiated body movement and sensory exploration</td>
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<tr>
<td></td>
<td>19. Child demonstrates pleasure after successfully accomplishing activities</td>
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<td></td>
<td>22. Child accepts help when necessary</td>
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<td></td>
<td>24. Child demonstrates an awareness that own behavior has an effect on people and objects</td>
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<td></td>
<td>37. Child generally demonstrates a happy disposition</td>
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<td></td>
<td>38. Child expresses a range of feelings</td>
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<td></td>
<td>41. Child initiates exploration of own body or objects using a variety of strategies</td>
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<tr>
<td><strong>Preference and choice</strong></td>
<td>4. Child maintains visual attention to people and objects</td>
</tr>
<tr>
<td></td>
<td>17. Child accepts warmth and support from familiar persons</td>
</tr>
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<td></td>
<td>31. Child responds to vocal or gestural direction</td>
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<td></td>
<td>33. Child expresses likes and dislikes</td>
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<td></td>
<td>34. Child initiates action to communicate a need</td>
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<tr>
<td><strong>Decision making</strong></td>
<td>18. Child reacts to feelings and moods of other people</td>
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<td></td>
<td>23. Child uses a variety of behaviors to respond to others</td>
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<td></td>
<td>25. Child uses behavior appropriate to the situation</td>
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<td></td>
<td>26. Child accepts substitute people or objects when necessary</td>
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<td></td>
<td>29. Child finds a way of handling a new or difficult situation</td>
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<td></td>
<td>42. Child applies a previously learned behavior to a new situation</td>
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<td></td>
<td>44. Child changes behavior when necessary to solve a problem or achieve a goal</td>
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<tr>
<td></td>
<td>48. Child balances independent behavior with necessary dependence on adults</td>
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<tr>
<td><strong>Engagement and persistence</strong></td>
<td>15. Child has an energy level that is forceful and vigorous (e.g., the child has the energy to participate in activities)</td>
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<td></td>
<td>21. Child engages in reciprocal social interactions (e.g., mutual give and take)</td>
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<td></td>
<td>30. Child bounces back after stressful situations</td>
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<td></td>
<td>35. Child initiates interactions with others</td>
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<td></td>
<td>36. Child gives warmth and affection to others</td>
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<td></td>
<td>40. Child tries new behavior on own</td>
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<td></td>
<td>43. Child demonstrates persistence during activities</td>
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<td></td>
<td>45. Child enters new situations easily or cautiously as the occasion demands</td>
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<td></td>
<td>46. Child actively participates in situations</td>
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<td></td>
<td>47. Child completes self-initiated activity</td>
</tr>
<tr>
<td>Appropriated control over the environment (Self-regulation)</td>
<td>1. Child responds to a variety of sounds (e.g., voices, toys, soft to loud noises)</td>
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<tr>
<td>-----------------------------------------------------------</td>
<td>------------------------------------------------------------------</td>
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<tr>
<td></td>
<td>2. Child adjusts to irrelevant sounds in the environment</td>
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<td>3. Child reacts to a variety of visual stimuli (e.g., people, objects, range of patterns or colors)</td>
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<td></td>
<td>5. Child reacts to different types of touch experiences (e.g., holding by caregiver, water play, clothing)</td>
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<td></td>
<td>6. Child adapts to a range of intensity of touch (e.g., from light to firm touch during handling)</td>
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<td></td>
<td>7. Child tolerates being in a variety of positions (e.g., lying on back; abdomen or side; being held upright; sitting; standing)</td>
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<td></td>
<td>8. Child adapts to being moved by others during physical handling and caregiving</td>
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<td></td>
<td>10. Child organizes information from the different senses simultaneously for a response (e.g., combines looking, listening, and touching in exploring a toy)</td>
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<td></td>
<td>12. Child adapts movements to be responsive to specific situations</td>
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<td></td>
<td>13. Child demonstrates self-regulation of basic body functions (e.g., sleep/wake patterns, feeding schedule)</td>
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<td></td>
<td>14. Child demonstrates ability to self-comfort</td>
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<td>16. Child varies activity level according to the situation</td>
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<tr>
<td></td>
<td>20. Child demonstrates frustration tolerance in routine or new situation</td>
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<tr>
<td></td>
<td>27. Child adapts to daily routines and limits set by caregiver</td>
</tr>
<tr>
<td></td>
<td>28. Child adapts to changes in the environment</td>
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<tr>
<td></td>
<td>32. Child uses self-protective behaviors to control the impact of the environment (e.g., withdraws from or stops the activity when over-stimulated; fusses when tired)</td>
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<tr>
<td></td>
<td>39. Child anticipates events</td>
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<tr>
<td>Items unable to match</td>
<td>11. Child demonstrates coordinated movements</td>
</tr>
</tbody>
</table>
APPENDIX 2: DETERMINE THE PRESENCE OF ASSISTIVE TECHNOLOGY FOR CHILDREN WITH CP IN GMFCS LEVEL III-V

For mobility:
- Question (Mobility questionnaire in Time 3 parent booklet):
  MOB1a How does your child MOST OFTEN move around AT HOME (INDOORS)?
  MOB2a How does your child MOST OFTEN move around AT PRESCHOOL / CHILDCARE / KINDERGARTEN (INDOORS)?
  MOB3a How does your child MOST OFTEN move around INSIDE COMMUNITY BUILDINGS
  MOB4a How does your child MOST OFTEN move around OUTDOORS?
- Criteria:
  1. with adult’s assistance → 0
  2. Rolling or walking along furniture → 0
  3. Moving with aid → 1
- If the answer meets the criteria, one point will be earned from each above question.
  Up to 4 points can be earned.
- Score: an average score of 4 questions

For communication:
- Question (Communication method in Child Health Part A- CHA16):
  What’s your child’s usual method of communication?
- Criteria
  1. Speech → 0
  2. Communicate with device → 1
  3. Sign language or gesture → 0

Score Presence of Assistive Technology for Self-Determination
- Score of mobility + score of communication (ranged from 0 to 2)
**VITA**

**BIOGRAPHICAL SKETCH**

<table>
<thead>
<tr>
<th>NAME</th>
<th>Chang, Hui-Ju</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EDUCATION / TRAINING</strong></td>
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<tr>
<td>INSTITUTION AND LOCATION</td>
<td>DEGREE</td>
</tr>
<tr>
<td>Drexel University, Philadelphia, PA</td>
<td>Ph.D.</td>
</tr>
<tr>
<td>Chang Gung University, Taoyoun, Taiwan</td>
<td>M.S.</td>
</tr>
<tr>
<td>Chang Gung University, Taoyoun, Taiwan</td>
<td>B.S.</td>
</tr>
</tbody>
</table>

A. Personal Statement

I am a professional pediatric physical therapist dedicated to enhancing self-determination and participation for children with special needs. I am excellent with research methodology, statistical skills, and teaching skills, which provide me a foundation to collaborate well with faculty and students. I am a conscientious individual with strong work ethic and organizational skills who seeks professional challenges.

B. Positions and Honors

**Positions and Employment**


2003-2004  Research Assistant, School and Graduate Institute of Physical Therapy, National Taiwan University, Taipei, Taiwan.

2004-2006  Graduate Research Assistant, Graduate Institute of Rehabilitation Science, Chang Gung University, Taoyuan, Taiwan.

2006-2007  Pediatric Physical Therapist, Department of Rehabilitation, Chang Gung Memorial Hospital: LinKou Medical Center, Taiwan & Chang Gung Children’s Hospital, Taoyuan, Taiwan.

2007-2011  Graduate Research Assistant, Department of Physical Therapy and Rehabilitation Science, Drexel University, Philadelphia, PA, USA.
Licensure and Professional Memberships

2003-present  Licensed Physical Therapist in Taiwan
2003-present  Member, Physical Therapy Association of Taiwan
2008-2010  Member, American Physical Therapy Association

Honors

2002  The academic scholarships for bachelor students, Fall semesters, Chang Gung University
2004  The academic scholarships for graduate students, Fall semesters, Chang Gung University
2006  Summa cum laude in Graduate Institutes of Rehabilitation Science, Chang Gung University
09/2007-05/2009  Provost scholarship for graduate students, Drexel University, Philadelphia, PA
2008-2010  Graduate Travel Subsidy Award, Drexel University, Philadelphia, PA,
2010  Scholarship for international conference, Ministry of Education, Taiwan

C. Selected Peer-reviewed Publications

Published Journal Articles


**Published Abstract**


