

**School of Psychology and Speech Pathology**

**Faculty of Health Sciences**

**An Investigation of Parenting in Relation to Motor and Language  
Development in Young Children**

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## Declaration

I, Christina Lee Roberts, declare to the best of my knowledge and beliefs this thesis titled: “An Investigation of Parenting in Relation to Motor and Language Development in Young Children” contains no material previously published by any other person except where due acknowledgment has been made. This thesis contains no material which has been accepted for the award of any other degree or diploma in any university.

Signature:

A handwritten signature in blue ink, appearing to read 'Chen', with a horizontal line underneath.

Date: 19<sup>th</sup> December 2013

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## **Dedication**

To my late father, who had instilled and taught me about hard-work and perseverance. Thank you papa and I miss you very much.

Lastly, I would like to dedicate this thesis to the most important person in my life, my husband, Paul. I would not have come this far without your unconditional love, support, patience, encouragement and understanding. Thank you for providing me with the unending encouragement, support and love during this long journey.

## Abstract

Research has shown that parental behaviours play a role in children's motor (Chiarello & Palisano, 1998; Cress, Moskal, & Hoffman, 2008; Lomax-Bream et al., 2007; Treyvaud et al., 2009), and language development (Hirsh-Pasek & Burchinal, 2006; Kim & Mahoney, 2004; Landry, Smith, Swank, Assel, & Vellet, 2001; Magill-Evans & Harrison, 1999, 2001; Masur, Flynn, & Eichorst, 2005; Warren, Brady, Sterling, Fleming, & Marquis, 2010). Moreover, a number of studies have revealed that motor and language development amongst young children are intertwined (Campos et al., 2000; Iverson, 2010; Viholainen et al., 2006; Vukovic, Vukovic, & Stojanovic, 2010; Wang, Lekhal, Aarø, & Schjølberg, 2014), and have identified co-morbidity between children with developmental coordination disorder and language impairment (Archibald & Alloway, 2008; Dyck & Piek, 2010). Whilst the existing literature has documented possible linkages between parenting, and motor and language development, limited research has been undertaken to examine the possible causal relationships of these linkages by using mediation modeling.

Different measures such as interviews, assessments reported by primary caregivers, the parent or the child, and observational methods, have been widely used to assess parental behaviours. With different measures in parenting, it has not been possible to systematically compare and contrast different research outcomes, or to define and measure what are the most important qualities of parental behaviours. This raises an important practical issue related to measuring parenting, which has hampered progress in determining the precise relationship between parenting and specific developmental outcomes for children (Essau, Sasagawa, & Frick, 2006; Shelton, Frick, & Wootton, 1996). Therefore, the present research aimed to examine the possible relationship between parenting, and motor and language development, using two different measures of parenting, namely, mother-reported assessments and a naturalistic observational approach.

The present thesis consisted of three different studies. Study 1 involved 183 mothers and their typically developing children aged from four to six years, and utilised the mother-reported assessment known as Parenting Behaviours and Dimensions Questionnaire (PBDQ; Reid, Piek, Roberts, & Roberts, 2012) to assess parenting. The Movement Assessment Battery for Children, Edition 2, was used to

assess children's motor development including manual dexterity, aiming, catching and balance, and the Clinical Evaluation of Language Fundamentals Preschool-2 was employed to measure receptive and expressive language. Potentially confounding variables, including the child's age, mother's age and level of education, family income, and ethnicity were controlled. Three mediation models were tested to examine the relationship between parental behaviour (Model 1: punitive discipline, autonomy support and democratic discipline; Model 2: emotional warmth; Model 3: permissive discipline), motor (manual dexterity, aiming and catching, balance) and language (receptive and expressive language) development. The overall result partially supported the hypotheses. Models 1 and 3 showed that there was a significant relationship between fine motor skills (manual dexterity) and receptive and expressive language. As for Model 2, the result revealed that parenting (emotional warmth) was correlated with fine motor skills (manual dexterity), as was the relationship between fine motor skills and receptive and expressive language.

In Study 2, parenting was examined using a naturalistic observation method, in which mother-child interactions were videotaped during a free-play session that lasted about 20 minutes at home. These interactions were systematically coded by utilising the Maternal Behavior Rating Scale Revised (MBRS-R; Mahoney, 2008). Interrater reliability was established together with the main author and three independent raters. In this study, two mediation models were tested to examine the relationship between parenting (Model 1: responsiveness, affect, and achievement orientation; Model 2: directiveness), fine motor skills (manual dexterity) and language (receptive and expressive language) development. Model 1 showed that parents who were responsive, affective, and achievement-oriented significantly predicted children's fine motor skills and receptive and expressive language. Model 2 also indicated that directive parents were a predictor of children's fine motor skills, as was the relationship between fine motor skills and receptive and expressive language.

Study 3 was an exploratory study using canonical correlation to determine whether there was convergent validity between the different constructs of parenting measured by the PBDQ and MBRS-R. The results showed that the constructs of parenting in PBDQ and MBRS-R were not correlated. Although Pearson's

correlation analyses revealed that punitive discipline subscale was associated with directiveness subscale, as was democratic discipline subscale with achievement orientation subscale.

Whilst the results of the present study did not fully support the link of parenting, motor and language development, they highlight the importance of parenting that could support children's motor and language development. In addition, the result also added to the existing research that motor and language development could be related. More importantly, the findings of this study suggest that different parenting measures, namely, parent-reported assessment and observational methods, may have a significant impact on the results obtained. This study not only provides the evidence that there is a need for valid, accurate and reliable measures of parenting, it also assists researchers and clinicians in their consideration of the use of self-report assessment and observational methods, as the outcome may differ greatly when assessing the relationship between parenting and developmental outcomes in young children.

# Table of Contents

<b>Declaration</b> .....	<b>ii</b>
<b>Acknowledgments</b> .....	<b>iii</b>
<b>Dedication</b> .....	<b>v</b>
<b>Abstract</b> .....	<b>vi</b>
<b>Table of Contents</b> .....	<b>ix</b>
<b>List of Figures</b> .....	<b>xiv</b>
<b>List of Tables</b> .....	<b>xv</b>
<b>List of Abbreviations</b> .....	<b>xvii</b>
<b>Chapter 1 Introduction</b> .....	<b>1</b>
1.1 Aim and Scope of Study .....	6
<b>Chapter 2 Parent-Child Interaction</b> .....	<b>10</b>
2.1 Parent-Child Interaction: Internal Working Model.....	10
2.2 Parenting Models .....	13
2.2.1 Parenting styles. ....	13
2.2.2 Parenting practices. ....	17
2.2.3 Summary. ....	18
2.3 Different Dimensions of Parenting Behaviours .....	18
2.3.1 Responsiveness. ....	19
2.3.2 Warmth.....	20
2.3.3 Affect.....	21
2.3.4 Achievement orientation. ....	21
2.3.5 Directiveness. ....	22
2.3.6 Disciplinary strategies: punitive, democracy, permissive and autonomy support.....	23
2.3.7 Summary. ....	25
2.4 Approaches Used to Measure Parenting .....	25
2.4.1 Interviews.....	26
2.4.2 Parent-reported questionnaires.....	26
2.4.3 Observation methods.....	31
2.5 Summary .....	37
<b>Chapter 3 Parent-Child Interaction, Motor and Language Development</b> .....	<b>39</b>
3.1 Dynamic Systems Theory and Development.....	39

3.2 Parent-Child Interaction and Children's Language Development.....	42
3.3 Parent-Child Interaction and Children's Motor Development .....	48
3.4 Links between Motor and Language Development .....	52
3.5 Summary .....	56
<b>Chapter 4 Research Rationale, Aims and Significance .....</b>	<b>57</b>
4.1 Research Significance .....	61
4.2 Overall Research Plan .....	62
4.2.1 Study 1. ....	62
4.2.2 Study 2. ....	63
4.2.3 Study 3. ....	65
<b>Chapter 5 Study 1 .....</b>	<b>66</b>
5.1 Overview .....	66
5.2 Method .....	68
5.2.1 Participants.....	68
5.2.2 Measures. ....	71
5.2.2.1 Parenting behaviours and dimensions questionnaire.....	71
5.2.2.2 Motor skills. ....	71
5.2.2.3 Receptive and expressive language skills. ....	72
5.2.2.4 Cognitive skills. ....	72
5.2.2.5 Parent questionnaire.....	73
5.2.3 Procedure.....	73
5.2.4. Statistical analyses. ....	74
5.3 Results .....	75
5.3.1 Descriptive statistics. ....	75
5.3.2 Assumption testing for Pearson's $r$ . ....	78
5.3.2.1 Normality. ....	79
5.3.2.2 Linearity. ....	80
5.3.2.3 Homoscedasticity. ....	81
5.3.3 Pearson's correlation.....	81
5.3.4 Assumption testing for structural equation modelling.....	84
5.3.4.1 Multivariate normality and multicollinearity. ....	84
5.3.5 LISREL analysis: Structural equation modelling .....	84
5.3.5.1 Fit indices. ....	85
5.3.5.2 Model 1. ....	85

5.3.5.3 Model 2.....	90
5.3.5.4 Model 3.....	94
5.3.4.4 Summary for Models 1, 2 & 3 Results.....	98
5.4 Discussion.....	98
5.4.1 Model 1 (Punitive Discipline, Autonomy Support, Democratic Discipline). 99	
5.4.2 Model 2 (Emotional Warmth).....	101
5.4.3 Model 3 (Permissive Discipline).....	102
5.4.4 Impact of control variables in parenting behaviours.....	103
5.4.5 Limitations.....	105
5.4.6 Summary.....	105
<b>Chapter 6 Study 2 .....</b>	<b>107</b>
6.1 Overview.....	107
6.2 Method.....	110
6.2.1 Participants.....	110
6.2.2 Measures.....	112
6.2.3 Procedure.....	1122
6.2.3.1 Interrater reliability.....	1133
6.2.4 Statistical analyses.....	114
6.3 Results.....	115
6.3.1 Interrater reliability.....	115
6.3.1.1 Intraclass correlation coefficient.....	117
6.3.1.2 Analysis of variance.....	117
6.3.2 Descriptive statistics.....	118
6.3.3 Assumption testing for Pearson's r.....	120
6.3.3.1 Normality.....	120
6.3.3.2 Linearity.....	121
6.3.3.3 Homoscedasticity.....	122
6.3.4 Pearson's correlation.....	1222
6.3.5 Assumption testing for structural equation modelling.....	125
6.3.5.1 Multivariate normality and multicollinearity.....	125
6.3.5.2 LISREL analysis: Structural equation modelling.....	125
6.3.5.3 Fit indices.....	127
6.3.5.4 Model 1.....	127

6.3.5.5 Model 2 .....	130
6.4 Discussion .....	135
6.4.1 Correlations between latent variables. ....	136
6.4.2 Model 1: Responsiveness, Affect, and Achievement Orientation .....	136
6.4.3 Model 2: Directiveness .....	139
6.4.4 Impact of control variables in parenting behaviours.....	141
6.4.5 Limitations. ....	142
6.4.6 Conclusion .....	144
<b>Chapter 7 Study 3 .....</b>	<b>146</b>
7.1 Overview .....	146
7.2 Method .....	148
7.2.1 Participants, measures and procedure. ....	148
7.2.2 Statistical analyses. ....	148
7.3 Results .....	149
7.3.1 Descriptive statistics. ....	149
7.3.2 Assumption testing for canonical correlation. ....	150
7.3.3 Pearson’s correlation.....	153
7.3.4 Canonical correlation. ....	155
7.4 Discussion .....	155
<b>Chapter 8 General Discussion and Conclusions.....</b>	<b>160</b>
8.1 The Mediation Model.....	161
8.2 Parenting Behaviours and Motor Development.....	162
8.3 Parenting Behaviours and Language Development .....	164
8.4 The Relationship between Motor and Language Development.....	166
8.5 Self-Report Assessment versus Observation .....	168
8.6 Strengths of Study .....	171
8.7 Limitations of Study.....	172
8.8 Future Direction .....	175
8.9 Conclusions .....	177
<b>References .....</b>	<b>179</b>
<b>Appendix A: Approval from Human Research Ethics Committee of Curtin University .....</b>	<b>240</b>
<b>Appendix B: Approval from Department of Education, Western Australia ...</b>	<b>241</b>
<b>Appendix C: Approval from Catholic Education Office, Western Australia ..</b>	<b>242</b>

<b>Appendix D: Information Letter for School.....</b>	<b>243</b>
<b>Appendix E: Consent Form for School.....</b>	<b>246</b>
<b>Appendix F: Removed .....</b>	<b>247</b>
<b>Appendix G: Parent Questionnaire.....</b>	<b>248</b>
<b>Appendix H: Information Letter for Parent .....</b>	<b>249</b>
<b>Appendix I: Information Sheet for Young Children .....</b>	<b>253</b>
<b>Appendix J: Consent Form for Parent.....</b>	<b>254</b>
<b>Appendix K: Consent Form for Young Children .....</b>	<b>255</b>
<b>Appendix L: Removed .....</b>	<b>256</b>
<b>Appendix M: SPSS and LISREL Outputs for Study 1.....</b>	<b>257</b>
<b>Appendix N: SPSS and LISREL Outputs for Study 2 .....</b>	<b>280</b>
<b>Appendix O: SPSS and LISREL Outputs for Study 3 .....</b>	<b>306</b>

## List of Figures

<i>Figure 4.1.</i> Proposed mediation model to examine the possible causal relationships between parenting behaviours (parent-reported assessments), motor development and language development. ....	63
<i>Figure 4.2.</i> Proposed mediation model to examine the possible causal relationships between parenting behaviours (observation), motor development and language development. ....	64
<i>Figure 4.3.</i> Proposed canonical correlation analyses between the PBDQ and the MBRS-R variables. ....	65
<i>Figure 5.1.</i> Model 1: Measurement model (in red) and structural model (in blue)..	87
<i>Figure 5.2.</i> Model 2: Measurement model (in red) and structural model (in blue)..	92
<i>Figure 5.3.</i> Model 3: Measurement model (in red) and structural model (in blue)..	97
<i>Figure 6.1.</i> Model 1: Measurement model (in red) and structural model (in blue).	130
<i>Figure 6.2.</i> Model 2: Measurement model (in red) and structural model (in blue).	138
<i>Figure 7.1.</i> Proposed canonical correlation analyses between the PBDQ and the MBRS-R variables. ....	152

## List of Tables

Table 2.1 <i>Removed</i> .....	14
Table 2.2 <i>Examples of Parenting Dimensions Measured by Different Assessments</i> .	31
Table 5.1 <i>Demographic Information of Mothers and Families for Study 1 (N = 183)</i> .....	70
Table 5.2 <i>Means, Standard Deviations, and Ranges for the Study Variables (N = 183)</i> .....	78
Table 5.3 <i>Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 183)</i> .....	80
Table 5.4 <i>Pearson’s Correlations between Indicators and Potential Control Variables (N = 183)</i> .....	82
Table 5.5 <i>Pearson’s Correlations among Indicators: First Order Correlations above Diagonal, Partial Correlations below Diagonal (N = 183)</i> .....	83
Table 5.6 <i>Model 1: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Punitive Discipline, Autonomy Support, Democratic Discipline), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development</i> .....	88
Table 5.7 <i>Correlations between Latent Variables in Model 1</i> .....	89
Table 5.8 <i>Model 2: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Emotional Warmth), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development</i> .....	91
Table 5.9 <i>Correlations between Latent Variables in Model 2</i> .....	93
Table 5.10 <i>Model 3: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Permissive Discipline), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development</i> .....	95
Table 5.11 <i>Correlations between Latent Variables in Model 3</i> .....	98
Table 6.1 <i>Demographic Information of Mothers and Families for Study 2 (N = 84)</i> .....	111

Table 6.2 <i>Removed</i> .....	113
Table 6.3 <i>Means and Standard Deviations for MBRS-R Subscales Rated by Each Rater and Agreements between Raters (N = 20)</i> .....	120
Table 6.4 <i>Intraclass Correlation Coefficient and Confidence Interval of MBRS-R Subscales (N = 20)</i> .....	121
Table 6.5 <i>Means, Standard Deviations, and Ranges for the Study Variables (N = 84)</i> .....	123
Table 6.6 <i>Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 84)</i> .....	125
Table 6.7 <i>Pearson’s Correlation between Indicators and Potential Control Variables (N = 84)</i> .....	127
Table 6.8 <i>Pearson’s Correlations among Indicators: First Order Correlations above Diagonal, Partial Correlations below Diagonal (N = 84)</i> .....	128
Table 6.9 <i>Model 1: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Responsiveness, Affect, and Achievement Orientation), Motor (Manual Dexterity), and Receptive and Expressive Language</i> .....	133
Table 6.10 <i>Correlations between Latent Variables in Model 1</i> .....	134
Table 6.11 <i>Model 2: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Directiveness), Motor (Manual Dexterity), and Receptive and Expressive Language</i> .....	136
Table 6.12 <i>Correlations between Latent Variables in Model 2</i> .....	139
Table 7.1 <i>Means, Standard Deviations, and Ranges for the Two Sets of Variables (N = 84)</i> .....	154
Table 7.2 <i>Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 84)</i> .....	156
Table 7.3 <i>Pearson’s Correlation Matrix for the Key Variables (N = 84)</i> .....	158

## **List of Abbreviations**

APQ	Alabama Parenting Questionnaire
CELF PRE-2	Clinical Evaluation of Language Fundamentals – Preschool Second Edition
CI	Confidence interval
DCD	Developmental Coordination Disorder
DPCIS	Dyadic Parent-child Interaction Scale
HOME	Home Observation Measurement of Environment
IBCS	Interpersonal Behavior Constructs System
ICC	Intraclass correlation coefficient
MABC-2	Movement Assessment Battery for Children – Second Edition
MBRS-R	Maternal Behavior Rating Scale Revised
NCATS	Nursing Child Assessment Teaching Scale
PAQ	Parenting Authority Questionnaire
PAQ-R	Parenting Authority Questionnaire Revised
PBDQ	Parenting Behaviours and Dimensions Questionnaire
PIQ	Performance Intelligence Quotient
PS	Parenting Scale
PSDQ	Parenting Styles and Dimensions Questionnaire
SLI	Specific Language Impairment
SIRS	Social Interaction Rating Scale
SPSS	Statistical Package for the Social Sciences
VIQ	Verbal Intelligence Quotient
WPSSI-III	Wechsler Preschool and Primary Scale of Intelligence, Third Edition

# Chapter 1

## Introduction

Different qualities of parenting have been identified that can support or hinder children's developmental outcomes. Parent-child interaction is one of the most common measures used by researchers and clinicians to assess parenting behaviours. Parent-child interaction describes a set of observable behaviours or interactions between parents and their children that involves a parent's response or sensitivity towards the child's verbal and non-verbal cues in a timely and appropriate manner, leading to secure attachment (Baggett & Carta, 2006; Balbernie, 2013; Benoit, 2004). Parent-child interactions are also the cues and responses provided between parents and their children that enable both of them to either adapt their own behaviours or modify the behaviour of others (Vohr et al., 2010). Furthermore, the quality of parent-child interaction is fostered through an emotional bond or secure attachment between parents and their children (Bee, 1995). Studies have consistently demonstrated that parent-child interactions are driven by parents' intention or objective when they interact with their children (Mahoney, Fors, & Wood, 1990). Early parent-child interaction provides a fundamental foundation for the child to establish positive and quality interaction with his or her parent(s) (Brazelton & Greenspan, 2000; Cabrera, Fagan, Wight, & Schadler, 2011; Shmukler, 1981; Singer & Singer, 2005; Topping, Dekhinet, & Zeedyk, 2011).

Although studies of parent-child interactions have greatly contributed to, and extended, our knowledge of their impact on children's developmental outcomes, different terminologies have been used to define the parent-child interaction. This includes "parent-child (or mother-child) relationship", "dyadic interactive behaviour", "parent (or maternal) interactive style", "parent-child effect", and "parenting behaviour" (Easterbrooks, Bureau, & Lyons-Ruth, 2012; Farmer & Lee, 2011; Hudson & Rapee, 2001; Stack et al., 2012). In contrast, other researchers have used "parenting behaviours" to define specific parental child-rearing behaviours (Dadds, Maujeen, & Fraser, 2003; McClure, Brennan, Hammen, & Le Brocque, 2001). Similarly, "parenting style" and "parenting practices" have also been used interchangeably in existing parenting literature although some researchers have

pointed out that these terms describe different parenting models (Darling & Steinberg, 1993; Maccoby, 1992).

In the context of parenting, “parenting style” is described as a global set of parent perceptions or approaches, objectives, and patterns of parenting practices that support or hinder a positive emotional environment or climate (Darling & Steinberg, 1993). Emotional climate is described as a diverse range of emotions (such as trust, security, fear and anger) perceived in others that is in contrast to one’s emotional experience (De Rivera & Páez, 2007). Holden and Edwards (1989) posit that “parenting style” is customarily appraised with paper-and-pencil measures, in which the respondent is required to evaluate global patterns of parenting behaviours over unspecified or extended periods of time. On the other hand, “parenting practices” are characterised as specific, goal-oriented parenting behaviours that are used in specific content and socialisation goals (Darling & Steinberg, 1993; Holden & Miller, 1999; Pomerantz & Eaton, 2001; Wood, McLeod, Sigman, Hwang, & Chu, 2003). For example, the construct of parenting practices has focused on several important parenting behaviours such as parental involvement, parental monitoring, and parental goals, values and aspirations (Spera, 2005). Parenting practices are generally measured with observational methods in a specific period of time, context, and setting.

Therefore, in the present study, consistent terminology including “parent-child interaction” is used to indicate a combination of observed interactive behaviours between parent and the child. “Parenting behaviour” is used to indicate self-report or observation of specific parental child-rearing behaviours (Easterbrooks et al., 2012; Farmer & Lee, 2011; Hudson & Rapee, 2001; Stack et al., 2012), whereas, “parenting” is used to define the different parenting milieus that have been identified in the past research: (a) parent-child interactions; (b) parenting behaviours; (c) parenting styles; and (d) parenting practices.

Parenting is commonly measured through various research methodologies such as questionnaires, rating scales, semi-structured or structured interviews, and observational approaches, applied to a primary caregiver, child or parent, in a laboratory or at home. Although different methodologies have been developed to determine different qualities of parenting, there is a lack of agreement among sources

and methods of information obtained from different measurements such as parent-reported questionnaires and observer ratings (O'Connor, 2002). In addition, irrespective of the assessment strategies used to measure parenting, there is substantial variance between available research methods (O'Connor, 2002). This phenomenon warrants further investigation to find a standardised measurement tool to measure parenting so that sources of information obtained are validated and made reliable. This is important as the existing literature has widely documented that parenting during infancy and early childhood plays a significant role in children's development.

In the past six decades, research has been carried out by researchers and clinicians to understand and determine the impact of parenting on children's developmental outcomes. These findings include positive correlations between parenting and cognitive (Cabrera et al., 2011; McFadden & Tamis-LeMonda, 2013), empathic (Tong et al., 2012) and social (Steelman, Assel, Swank, Smith & Landry, 2002) development, and also self-regulated learning such as motivation (Pino-Pasternak & Whitebread, 2010), expressive language (Landry, Smith, Swank, Assel, & Vellet, 2001; Masur, Flynn, & Eichorst, 2005; Warren, Brady, Sterling, Fleming, & Marquis, 2010), receptive language (Magill-Evans & Harrison, 1999), and motor development (Chiarello, & Palisano, 1998; Cress et al., 2008; Lomax-Bream et al., 2007).

Similarly, some observational studies have demonstrated that parent-child interactions are negatively associated with developing and maintaining psychopathology such as anxiety (Wood et al., 2003), antisocial behaviour (Rhee & Waldman, 2002), and conduct disorder (Lahey & Waldman, 2012). In addition, the quality of parent interactive behaviours has been consistently linked with a parent's history of depression, education level, socioeconomic status, and ethnicity (Fulgini & Brooks-Gunn, 2013; Hoff, 2003; Karrass, Braungart-Rieker, Mullins, & Lefever, 2002; Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Tamis-LeMonda, Briggs, McClowry, & Snow, 2008; Topping, Dekhinet, & Zeedyk, 2011). In contrast, some studies reveal that developmental outcomes in children, such as language attainment and academic achievement, are not related to family characteristics such as

socioeconomic status and the level of parents' education (Hirsh-Pasek & Burchinal, 2006; Zubrick, Taylor, Rice, & Slegers, 2007).

The influence of family characteristics such as socioeconomic status and parent's education is consistent with Bowlby's (1973, 1988) proposal, in which both quality of parent-child interaction and emotional interaction between parents and their children lead them to develop and shape an internal working model of self and others. Therefore, different communicative approaches to parent-child interactions in early childhood could shape the direct experience of sensitive care, but more importantly, such interactions could also contribute to secondary representations of experience that are mediated by language (Thomson, 2006). Whilst the existing literature of parent-child interaction has widely documented this interactive behaviour as a predictor of children's receptive and expressive language development (Landry et al., 2001; Lomax-Bream et al., 2007; Magill-Evans & Harrison, 1999; Masur et al., 2005; Warren et al., 2010), limited studies have been conducted to examine the association between parent-child interaction and motor development in young children (Chiarello & Palisano, 1998).

In addition, relatively few, though notable, studies have emphasised the relationship between motor and language development (Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Mundy et al., 2007; Oller, Eilers, Neal, & Schwartz, 1999; Wang, Lekhal, Aarø, & Schjølberg, 2014). According to the dynamic systems theory, developmental outcomes in children can be affected by the interaction between multiple sub-systems within the child, the demand of the task, and the environment (Newell, 1986). This includes parent-child interaction in shaping the child's behaviours (Lerner, 2006; Lewis, 2000; Thelen & Smith, 1994, 2006; Thelen, Schöner, Scheier, & Smith, 2001; Thelen, Ulrich, & Wolff, 1991; Ulrich, 1997). In language development, for example, the recurrence of interaction between internal (language) and external (effect of parent-child interaction) systems become the trajectory of an individual's language or meaning over time (Evans, 2002; Lerner, 2006; Thelen & Smith, 2006). According to some researchers, "signals, words, gestures and expressions do not *mean*, they are prompts for the construction of meaning" (Waters and Wilcox, 2002). Therefore, different forms of meaning significantly influence the final understanding or interpretation of a sentence (Elman,

1995). Thus the dynamic systems theory provides support for the possible relationship between parent-child interactions and the emergence of developmental outcomes amongst young children.

Similarly, the dynamic systems theory also provides a possible linkage between parent-child interactions and motor development. In this instance, motor development occurs as a result of interactions of multiple systems within the person, task and environment (Thelen, 1989). For example, recurring interactions amongst muscular and perceptual activities are likely to give rise to patterns of coordination, which in turn, motivate an infant's reaching for an object and walking (Kamm, Thelen, & Jensen, 1990; Thelen et al., 2001; Thelen & Smith, 1994). During an infant's first year, new motor skills are one of the most dramatic and observable changes. Early motor development in infants, for example, not only encourages and influences their exploratory and day-to-day interaction with their parents (Tamis-LeMonda & Bornstein, 2002), but can in turn shape both language and gestures with their mothers (Karasik, Tamis-LeMonda, Adolph, & Dimitropoulou, 2008). Thus learning of motor skills by infants is often accompanied by verbal interaction between parent and child. This is consistent with the assumption that there is a possible linkage between motor and language development (Campos et al., 2000; Iverson, 2010; Viholainen et al., 2006; Wang et al., 2014).

In addition, children's motor attainment not only encourages parent-child interactions as suggested by Tamis-LeMonda and Bornstein (2002), more importantly, children's motor skills could also provide the necessary opportunities to develop and acquire language skills (Karasik et al., 2008). For example, some researchers have highlighted that drawing could provide valuable multimodality learning opportunities for young children to express and understand meaning of words in different ways (Anning & Ring, 2004; Kress, 2000; Pahl, 2001; 2002). Therefore, when a child experiences difficulties in drawing (e.g., poor hand-eye coordination and fine motor skills), poor visual communication might lead to poor representation of newly learned objects or words, and this in turn, could be detrimental to the child's capacity to recall newly learned words, leading to poor vocabulary (Dockrell, Messer, & George, 2001; Tingley, Kyte, Johnson, & Beitchman, 2003). This is consistent with existing literature that suggests there is a

strong association between drawing and naming objects or words in children with and without specific language impairments (McGregor & Appel, 2002; McCregor, Newman, Reilly, & Capone, 2002).

Although a number of studies have suggested that motor functioning is closely related to growth and language development, particularly in children with language disorders and motor impairments (Adi-Japha, Strulovich-Schwartz, & Julius, 2011; Hill, 2001; Jäncke, Siegenthaler, Preis, & Steinmetz, 2007; Rechetnikov & Maitra, 2009; Ullman & Pierpont, 2005; Webster, Majnemer, Platt, & Shevell, 2005; Wisdom, Dyck, Piek, Hay, & Hallmayer, 2006), the interrelatedness of these key factors is not well understood. Taken together, although past studies have demonstrated that there is a relationship between parenting behaviours, and motor and language development, to our knowledge, no research has been undertaken to examine the possible impact of motor development in the relationship between parenting and language development.

### **1.1 Aim and Scope of Study**

A considerable amount of research has consistently demonstrated the association between parenting and children's developmental outcomes, particularly in infancy and toddlerhood. However, it appears that there is a gap in the existing literature where one would expect there to be an examination of how different qualities of parenting behaviour and parent interactive behaviour influence children's different developmental outcomes, particularly motor and language development. In addition, recent studies have demonstrated a possible linkage between motor and language development (Barbu-Roth et al., 2013; Campos et al., 2000; Iverson, 2010; Viholainen et al., 2006; Wang et al., 2014). Therefore, further investigation is warranted to advance our knowledge of the relationship between parenting, and motor and language development. Furthermore, limited research has focused on a systematic effort to measure parenting using two different evidence-based methodologies, namely, parent-reported questionnaire and naturalistic observation. Such in-depth analysis of parenting could yield critical information about early developmental trajectories with young children.

Therefore, the overall aim of the research for this thesis was to examine if there was a possible link between parenting, and motor and language development in

young children. In this thesis, three different studies were conducted using two different measures of parenting. Studies 1 and 2 examined the association between parenting, and children's developmental outcomes, particularly motor and language development. In particular, Study 1 aimed to provide preliminary evidence of a possible mediating relationship between parent child-rearing behaviours reported by mothers (predictor), motor (mediator), and language (outcome) development. Study 2 examined whether the relationship between parent-child interaction and language was mediated by motor development. This assumption is consistent with the empirical evidence supported by past research as discussed in Chapter 3. A third study (Study 3) involved an exploratory analysis comparing the different constructs of parenting in both PBDQ and MBRS-R. Such comparison could provide preliminary evidence that the information obtained from these sources and methods was valid and reliable.

This thesis consists of seven chapters. Chapter 2 presents an overview of the theoretical framework of parent-child interaction extending from the internal working model, as well as an overview of two different parenting models, namely parenting style and parenting practices that have been widely used in research of parenting. In addition, various assessment methods that were used to measure parenting, including their strengths and limitations, are also discussed. Different qualities of parenting behaviours including parental responsiveness, warmth, affect, achievement orientation, directiveness, and disciplinary strategies such as democracy, punitive, permissiveness, and autonomy support, that could affect the child's developmental outcomes, are discussed. The impact of family characteristics such as ethnicity, socioeconomic status, child's sex, age and verbal and non-verbal intelligence quotient (IQ), as well as maternal age and level of education, are also reviewed.

Chapter 3 presents the dynamic systems theory that provides the theoretical framework to support the hypothesis that parenting could have significant impact on children's developmental outcomes, particularly motor and language development. This chapter also reviews the existing literature that covers the topic of relationships between parenting, and motor and language development. The strengths and limitations of the studies reviewed are also discussed. Lastly, recent empirical

evidence of the link between motor and language development in typically developing children is also presented.

The rationale of this thesis is discussed in Chapter 4. In the same chapter, a brief summary of the key areas, aims and research significance, as well as an outline of Studies 1, 2 and 3, are also provided.

Chapter 5 presents Study 1, examining the possible linkages between different qualities of parenting behaviours (namely, Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline, and Democracy Discipline), as measured by a parent-report questionnaire; motor development (namely, Manual Dexterity, Aiming and Catching, and Balance), and language development (namely, Receptive and Expressive Language). The association between parenting behaviours and a child's development outcomes, particularly motor and language development, are discussed.

Chapter 6 describes Study 2, measuring parent-child interaction using naturalistic observation. This measure is used to investigate the possible links between different qualities of parent-child interactions (namely, Responsiveness, Affect, Achievement Orientation, and Directiveness), motor development (namely, Manual Dexterity, Aiming and Catching, and Balance), and language development (namely, Receptive and Expressive Language). The predictive relationships between parent-child interaction, and motor and language development, are provided.

In Chapter 7, an exploratory study (Study 3) was employed to examine the implication of using two different methodologies (mother-reported questionnaires versus naturalistic observation) to measure parenting. Study 3 also examined different constructs of parenting behaviours reported by mothers (Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline, and Democracy Discipline), and parent-child interaction (Responsiveness, Affect, Achievement Orientation, and Directiveness) observed in a naturalistic setting. The preliminary analysis was conducted using canonical correlation to determine the possible convergent validity of different constructs of parenting behaviours measured. Both the strengths and limitations of these measures to assess parenting are discussed.

Chapter 8 contains a summary, general discussion and conclusions related to the three studies. The limitations of the present research, and directions for future research, are also discussed.

## **Chapter 2**

### **Parent-Child Interaction**

#### **2.1 Parent-Child Interaction: Internal Working Model**

Attachment theory was developed in an attempt to understand the intense distress experienced by infants when they are separated from their primary caregivers (Bowlby, 1960, 1969, 1982). This framework was drawn from various disciplines including ethology, developmental psychology, cybernetics, information processing and psychoanalysis. Bowlby's framework is based on how parent-child bonding could be affected through separation, deprivation and bereavement. Bowlby (1969, 1973) argued that the environment and the child's early experience, particularly the bonding between parent and child, played a significant protective role from the development of psychopathology in later life. Bowlby (1960, 1969, 1982) posited that an infant's attachment behaviours such as clinging, crawling, crying, grasping, reaching, smiling and vocalising, are part of a behavioural system that has a directed-goal to gain proximity to his or her parents. From birth, an infant's attachment is strengthened by mutually satisfying interactions with his or her parents.

The attachment theoretical framework was expanded by other researchers including Ainsworth (1963), who systematically studied infant-parent separation in a laboratory paradigm with 44 mother-infant dyads aged 18 to 24 months. From these research findings, Ainsworth developed an experimental procedure called the "strange situation". During the strange situation, a series of separations and reunions between mother and infant were observed, as well as a stranger being introduced to the child. During the experiment, Ainsworth observed that infants often used their mothers as a base from which they explored the surroundings. Therefore, when mothers were available, responsive, and sensitive to their infant's needs, this appeared to provide a secure base for them to explore the surroundings. In addition, secure infants were more likely to return to their mothers when they felt uncertain or afraid, then stayed near their mothers and became distressed when separated. The central finding of Ainsworth's strange situation is based on the opportunity for the infant to establish a sense of security with the primary caregivers or parents. When the infant recognises that the parents are reliable, this further forms a secure foundation or base for the infant to explore and discover the world around him or

her. In the strange situation, Ainsworth developed a classification system that categorised attachment into three types: (a) secure; (b) avoidant; and (c) ambivalent attachment.

Secure attachment is characterised by infants seeking proximity to the primary caregiver when reunited. Although distressed by the separation, secure infants are relatively quick to recover and resume their exploration. Avoidant attachment is characterised by infants exhibiting anxious-avoidant behaviours (such as not looking at the attachment figure) when reunited with the primary caregiver. Avoidant infants are less distressed when separated and they have a greater tendency to explore rather than seeking proximity when reunited. Ambivalent attachment is characterised by infants exhibiting a combination of seeking proximity, resistant and angry behaviours towards the primary caregiver when reunited. Ambivalent infants are most distressed when separated from their primary caregivers, at times difficult to soothe, and relatively slow to resume their exploration. Past research has shown that secure children, when compared to insecure children, are more competent in their language development (Lemche, Kreppner, Joraschky, & Klann-Delius, 2007; Meins, 1998; Newcombe & Reese, 2004; van IJzendoorn, Dijkstra, & Bus, 1995), as well as demonstrating higher levels of self-esteem and psychomotor development (Wintgens et al., 1998).

Bowlby (1973, 1988) postulated that responsive and sensitive parenting during infancy results in a number of different observable patterns in attachment relationships or bonding between parent and infant. This dyadic interaction leads the child to develop a particular cognitive-affective schema or internal working model of both self and others. The different patterns of attachment are observed as the manifestation of individual differences in the child's internal working model. Bowlby proposed two processes which shape the internal working model: (a) the quality of parent to child interaction; and (b) emotional interaction. For example, in a quality parent-child interaction, young children can continue to enjoy the benefits of available and sensitive care, and in turn, they become increasingly receptive to their primary caregiver's influence and socialisation. This assumption was expanded by Bretherton (1990) who posits that the meanings derived from parent to child interactions, such as parents ignoring or inappropriately misinterpreting the infant's

emotional signals, could hold tremendous emotional significance for the child's developing model of self and others. Similarly, when parents encourage exploration of the inner world by modelling positive emotional interaction such as open relational experiences or relationships, their children are more likely to develop and attain an adaptive internal working model. When secure infants experience positive emotion through appropriate proximity-seeking behaviours from the primary caregivers, for example, these positive experiences become the underlying mental representation of self and other. This in turn helps the child to predict and understand what is needed to facilitate the development of a positive relationship with his or her parents. Bowlby (1979) highlighted that the internal working model of self and other established in the context of the parent-child relationship, could affect individual feeling, thought and behaviour in later adult relationships.

The internal working model in early childhood is shaped not only from the direct experience of sensitive care but it is also affected by the child's experiences that are mediated by language, specifically through different qualities of parent interactive behaviour towards the child (Thomson, 2006). Previous research has demonstrated that children who have a secure relationship with their parents often show a greater degree of positive emotional skill, cognitive, motor and language attainment (Belsky & Fearon, 2002; Bus & van IJzendoorn, 1988; Lemche et al., 2007; Meins, 1998; Spieker, Nelson, Petras, Jolley, & Barnard, 2003; Wintgens et al., 1998). Given the influence of parent-child interaction that creates possibilities for both maintaining and disrupting attachment relationships, the internal working model provides one of the fundamental foundations for the development of quality parent-child interaction (Abidin, 1992). When an internal working model of self and others is established in a positive emotional environment, for example, the same bonding or relationship is likely to facilitate and promote day-to-day parent-child interaction (Bowlby, 1979, 1980).

Some researchers have highlighted that early parent-child emotional bonding plays a critical role in children's early experience of parenting (Ainsworth, 1967; Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1973, 1988; De Wolf & van IJzendoorn, 1997). For example, a child with an emotionally warm and responsive parent would be more likely to develop a secure attachment with his or her parent.

Therefore, early parent-child emotional bonding has provided one of the fundamental foundations in parenting research (Ainsworth, 1967; Ainsworth et al., 1978), in which some of the theoretical frameworks of parenting models such as parenting style and parenting practices are founded.

## **2.2 Parenting Models**

### **2.2.1 Parenting styles.**

One of the parenting models that has been widely used to describe the phenomenology of parenting is Baumrind's (1966, 1967, 1971) parenting styles. Parenting style is defined as a global set of parenting approaches, objectives, and patterns of parenting behaviours, thought to establish an optimal emotional environment for the occurrence of parenting behaviour (Darling & Steinberg, 1993). In parenting literature, two different levels of analysis have been widely used to measure parenting: (a) typologies; and (b) dimensions of parenting behaviours. In a series of studies that employed different approaches utilising parent-reported assessments, interviews, and behavioural observations in a naturalistic setting and laboratory, Baumrind used typologies to conceptualise parenting behaviours into two broad dimensions as presented in Table 2.1: (a) demandingness; and (b) responsiveness.

In Baumrind's (1966, 1967, 1971) studies of parenting styles, demandingness is the expectation that parents have for their child to incorporate into the family structure by demanding maturity and providing guidance, supervision, firm discipline and confrontation of misbehaviour, whereas responsiveness is characterised as the degree to which parents deliberately foster individuality and self-regulation in their child (Baumrind, 1996; Maccoby & Martin, 1983). Baumrind (1967, 1971) conceptualised parenting behaviour as a direct combination of demandingness and responsiveness rather than multiple dimensions of parenting behaviours.

Therefore, the appropriate balance between demandingness and responsiveness is likely to foster a positive emotional environment that might encourage individuality and self-expression (Baumrind, 1991). Moreover, parenting styles are related to behaviours that happen over a wide scope of situations, creating a positive emotional environment in which parent-child interactions occur (Stewart & Bond,

2002). From the parenting typologies of demandingness and responsiveness, four widely known parenting styles are proposed (Baumrind, 1966, 1967, 1971), namely authoritative, authoritarian, permissive, and uninvolved (see Table 2.1).

Table 2.1 removed

Authoritative parents are deemed to be both demanding and responsive. Their behaviours typically are warm, stable, rational, autonomy supportive or non-intrusive, appropriate, and affectionate when interacting with their children (Saetermoe, Widaman, & Borthwick-Duffy, 1991; Taylor, Clayton, & Rowley, 2004). Authoritative parents also provide clear rules in a well-structured environment for their children. Authoritative parents have been found to be associated with children who are more socially competent, and have higher language attainment and academic achievement (Steelman et al., 2002; Taylor et al., 2004).

In contrast, authoritarian parents are highly demanding and directive, but they are low in responsiveness. Authoritarian parents often employ assertions without providing any explanation of punishments or expectations, coupled with high levels of negativity and conflict (Peterson & Rollins, 1987). Therefore, children with authoritarian parents often show higher degrees of anxiety, and lack of spontaneity and curiosity (Bertram, Schneider, & Ewaiwi, 2013).

Permissive parents are more responsive but they have lower levels of demandingness. Permissive parents are democratic though lenient, non-traditional, more conscientious, engaged, non-directive and avoid conflicts or confrontations. Permissive parenting has been found to be negatively correlated with the development of internalised behaviours such as anxiety, depression, withdrawn behaviours, and somatic complaints amongst adolescents (Williams et al., 2009).

Lastly, uninvolved parents have lower levels of demandingness and responsiveness, whereby they might be both rejecting-neglecting and neglectful. This parenting style reflects different naturally occurring patterns of parent's values, practices, and behaviours with an imbalance of responsiveness and demandingness.

Although Baumrind's (1966, 1967, 1971) parenting style has been widely used in parenting research, several limitations are identified. First, some researchers have

pointed out that the parenting dimensions of demandingness and responsiveness used in a parenting style may not adequately describe the phenomenology of parenting (O'Connor, 2002; Reid, 2012; Skinner, Johnson, & Snyder, 2005). For example, some researchers have pointed out that instead of a direct combination of demandingness and responsiveness, three different dimensions can be identified in existing parenting research: (a) parental warmth, which reflects affection, love, support, and acceptance; (b) the provision of structure or behavioural control, involving clear and consistent expectations and limits, discipline, and degree of monitoring of children's behaviour; and (c) psychological control, which reflects acting in ways that intrude upon a child's autonomy or intrinsic motivation, such as using coercion to control behaviour (O'Connor, 2002; Skinner et al., 2005).

Furthermore, recent research has shown that existing parenting measures provided limited evidence to support the common assumption that parenting dimensions are bipolar, having two extreme opposites (Skinner et al., 2005). According to Skinner et al. (2005), dimensions of parenting behaviours are defined as the characteristics, qualities, and explanatory theme employed to describe the phenomenology of parenting. Some of the dimensions of parenting behaviours that were identified by early researchers included acceptance as distinct from rejection, and dominance as distinct from submission (Symonds, 1939); love as distinct from hostility, and autonomy as distinct from psychological control (Schaefer, 1959, 1975); warmth as distinct from hostility, restrictiveness as distinct from permissiveness, and anxious as distinct from calm detachment (Becker, 1964). Dimensions of parenting behaviour such as structure and autonomy support, warmth and involvement from both teachers and parents have been demonstrated to be a positive predictor of children's psychosocial development (e.g., Grolnick & Ryan, 1989; Grolnick, Ryan, & Deci, 1991; Skinner & Belmont, 1993; Skinner & Edge, 2002; Skinner, Zimmer-Gembeck, & Connell, 1998; Stack, Serbin, Enns, Ruttle, & Barrieu, 2010).

In recent years, research has focused on the possibility of multiple dimensions of parenting behaviours in order to describe the central constructs of parenting style (Caron, Weiss, Harris, & Catron, 2006; Reid, 2012; Skinner et al., 2005). In this instance, Skinner et al. (2005) posit that the construct of parenting style can be

segmented into six dimensions of parenting behaviours, namely, warmth, autonomy support, chaos, coercion, structure, and rejection. Using structural analysis, Skinner et al. (2005) demonstrated that parenting behaviours can be better represented by multiple dimensions rather than pairing each dimension with its conceptually opposite dimension (warmth as distinct from rejection). For example, dimensions of parenting behaviours such as warmth and control can be represented by constructs such as nurture, the expression of affection, love, support, and regard (Locke & Prinz, 2002; Skinner et al., 2005), connectedness (Clark & Ladd, 2000), acceptance and supportiveness (Aunola & Nurmi, 2004), sensitivity (O'Connor, 2002), involvement (Aunola & Nurmi, 2004; Johnston, Murray, Hinshaw, Pelham, & Hoza, 2002), caring and love (Skinner et al., 2005), commitment (Grolnick & Ryan, 1989), structure, firm control, contingency (Seligman, 1975; Watson, 1979), restrictiveness, demandingness (Baumrind, 1991), assertive control, discipline (Locke & Prinz, 2002), and inductive control (Rollins & Thomas, 1979).

The advantage in using multiple dimensions of parenting behaviours is that they can be easily distinguished from each other, and more importantly, they can be differentiated from related constructs (Skinner et al., 2005). For example, dimensions of warmth and rejection can be distinguished from two sets of strongly interrelated constructs, namely, involvement and neglectful parenting, as well as supportive and unsupportive parenting. Conceptualisation of parenting with multiple dimensions not only reduces the source of terminological confusion, but more importantly it seems to capture the core phenomenology of parenting (Reid, 2012; Skinner et al., 2005).

Furthermore, although the dimensions of psychological control versus autonomy support were identified by early parenting researchers as having a significant influence on children's psychosocial outcomes (Schaefer, 1965), these constructs are often neglected in existing parenting measurements. Some researchers have also posited that psychological control should be distinguished and assessed separately from autonomy support (Barber & Harmon, 2002; Barber, Stolz, Olsen, Collins, & Burchinal, 2005; Stolz, Barber, & Olsen, 2005), as a weak to moderate correlation has been found between these constructs (Barber, Bean, & Erickson, 2002; Silk, Morris, Kanaya, & Steinberg, 2003). To capture the parenting dimensions of psychological control as distinct from autonomy support, the Parenting Behaviours

and Dimensions Questionnaire (PBDQ) was developed by Reid et al. (2012). This parent-reported questionnaire was derived from six different parent-report questionnaires that have been widely used by researchers and clinicians in parenting research by using a multiple dimensional approach.

In the PBDQ, five multiple dimensions of parenting behaviours were identified: (a) emotional warmth; (b) punitive discipline; (c) autonomy support; (d) permissive discipline; and (e) democratic discipline. The advantage of multiple dimensions of parenting behaviour is that new constructs can be easily added into any of the dimensions (Skinner et al., 2005). Another advantage of multiple dimensions of parenting behaviour is the potential for disaggregation of core parenting behaviours. In this instance, once the disaggregated core parenting dimensions are identified and operationally defined, they can be assessed either independently or jointly as clearly defined parenting styles according to the needs of the researcher (Reid, 2012).

### **2.2.2 Parenting practices.**

Parenting practices are defined as specific parent interactive behaviours showed in a specified time and situation when interacting with their children (Darling & Steinberg, 1993). In addition, parenting practices are hypothesised to have a direct effect on children's psychosocial, emotional and behavioural regulation (Darling & Steinberg, 1993). Specific parenting practices are generally measured with observational methods in specified periods of time and situations (Wood et al., 2003). For example, when interacting with their children to clean up their toys after playing with them, parents might employ certain practices such as demonstrating to the child where to keep different toys in specific boxes, and providing time for the child to understand what is required from him or her. Some of the global characteristics of parenting practices such as achievement orientation, directiveness, enjoyment, responsiveness, sensitivity and warmth that are incorporated from various parenting studies, have consistently associated with different aspects of a child's early development outcomes (Ainsworth, 1967; Ainsworth & Bell, 1975; Baumrind, 1971; Bayley & Schaefer, 1964; Clarke-Stewart, 1973; Donovan & Leavitt, 1978; Lewis & Leavitt, 1998; McCall, 1979; Schaefer, Bell, & Bayley, 1959; Stevenson, Leavitt, Roach, Chapman, & Miller, 1986; Yarrow, Rubenstein, & Pedersen, 1975).

### **2.2.3 Summary.**

Although the conceptualisations of parenting style and parenting practices are different, researchers and clinicians have consistently utilised the terms parenting styles and parenting practices interchangeably (Maccoby & Martin, 1983). Whilst global parenting style might affect the child's openness to interact with his or her parents, it is conceptualised as a moderator instead of a direct predictor of children's psychosocial outcomes (Darling & Steinberg, 1993). In addition, even though much of the research in parenting has stemmed from Baumrind's (1966, 1967, 1971) parenting styles, more recently, researchers have highlighted that multiple dimensions of parenting behaviour derived from different parenting measures are a better representation of parenting. Moreover, while empirically robust theories of parenting behaviours have been widely used for the past six decades in the history of parenting research, there has yet to emerge a single, comprehensive and definitive assessment to measure parenting (O'Connor, 2002). Thus multiple dimensions of parenting behaviours could provide the foundation for comprehensive and comparable parenting assessment in future research and clinical practice (Caron et al., 2006; Skinner et al., 2005), but more importantly, it also allows comparison of parenting research across studies.

### **2.3 Different Dimensions of Parenting Behaviours**

Research has shown that different dimensions of parenting behaviours such as responsiveness, affect, achievement orientation, directiveness, and warmth are significant predictors of children's developmental outcomes such as cognitive, language and social development (Deutscher, Fewell, & Gross, 2006; Fewell & Deutscher, 2002, 2004; Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998; McFadden & Tamis-LeMonda, 2013; Rimm-Kaufman, Voorhees, Snell, & La Paro, 2003; Stack et al., 2010). Other dimensions of parenting behaviours such as disciplinary strategies that include autonomy support, democratic discipline, punitive discipline, and permissive discipline were also found to be significant predictors of behavioural issues such as aggression, as well as psychosocial development such as self-esteem, social skill and academic achievement amongst young children (Reid, 2012).

However, research attempting to differentiate dimensions of parenting behaviours and their implications for children's developmental outcomes has been rare. In addition, some researchers have pointed out that parenting is not a uni-dimensional construct but instead consists of multiple dimensions of behaviours where parents might display some behaviours but not others (McFadden & Tamis-LeMonda, 2013; Reid, 2012). Therefore, this thesis focused on the specific dimensions of parenting behaviours, namely, responsiveness, warmth, affect, achievement orientation, directiveness, and disciplinary strategies that have been consistently related to children's developmental outcomes.

### **2.3.1 Responsiveness.**

One of the most consistently reported dimensions of parenting behaviours that has been related to children's developmental growth is parental responsiveness. Earlier researchers postulate that responsive parents often provide timely, liable, and appropriate (not simply contiguous) responses to the child's needs (Ainsworth, Bell, & Stayton, 1971; Bornstein & Tamis-LeMonda, 1989). Responsiveness is considered a "three-term chain of events": (a) the child's behaviour towards the parent; (b) the parent's response that supports the child's behaviour; and (c) the child's perception of the supportive behaviours from the parent (Ainsworth et al., 1978; Bornstein & Tamis-LeMonda, 1989). Recent research suggests that responsiveness is characterised by parents being attentive to their children, and adapting, modifying and responding appropriately to the constant changes to the child's communicative efforts and reactions (Woolbridge & Shapka, 2012).

Mahoney and MacDonald (2004) posit that responsive interaction involves encouraging and fostering the behaviours that the child has already accomplished, which provides a crucial opportunity for the child to enhance his or her capabilities in return. Therefore, it is likely that children could attain higher levels of development functioning because of recurring experience of this type of positive parenting behaviour. This in return encourages children to regularly engage in a constructive learning process, including imitation and joint attention (Landry, Smith, Miller-Loncar, & Swank, 1997). According to Martin (1989), parental responsiveness is a multifaceted construct that consists of several distinct, but conceptually related, components.

Children with responsive parents often show a greater level of engagement with both people and materials (Peterson, 2004). Typically, responsive parents provide explicit instructions and often promote behaviours that could engage and maintain children's interests (Akhtar, Dunham, & Dunham, 1991; Tomasello & Todd, 1983). Responsive parent behaviours have been found to be associated with typically developing children's cognitive and pro-social behaviours such as sharing and helping others, language, social and emotional development (Bornstein, Tamis-LeMonda, & Haynes, 1999; Carpenter, Nagell, & Tomasello, 1998; Davidov & Grusec, 2006; Dunst et al., 2001; Ensor, Spencer, & Hughes, 2009; Mahoney & Perales, 2003; McFadden & Tamis-LeMonda, 2013).

### **2.3.2 Warmth.**

Parental warmth is characterised as nurturing behaviours that foster positive parent-child interaction and emotional development, such as support, understanding, love, regard, and affection (Locke & Prinz, 2002; Skinner et al., 2005). Parents who display greater levels of warmth are more likely to provide their children with greater opportunities and context to express their positive emotions (Sroufe, Schork, Motti, Lawroski, & LaFreniere, 1984). Through such positive parent-child interaction, children could experience the intrinsic pleasure that is associated with such exchanges (MacDonald, 1992). In the context of parent-child interaction, warmth is a form of interaction that involves reciprocity between parents and their children (Russo & Owen, 1982).

Parents who are warm towards their children tend to promote psychosocial development in their children such as independence, positive self-esteem and self-adequacy, a positive view of self and others, as well as greater levels of emotional responsiveness, and emotional stability (Khaleque, 2013). Parental warmth, sensitivity, and non-hostility have also been found to be protective factors in predicting positive emotional development (Stack et al., 2010). Similarly, other researchers posit that parenting behaviours involving approval, flexibility, responsiveness, and warmth during an observed parent-child interaction activity, are associated with preschool children's task perseverance, a tendency to choose challenging activities, as well as greater levels of initiative in new activities (Estrada, Arsenio, Hess, and Holloway, 1987). In contrast, children with parents who have

lower levels of warmth often display greater degrees of externalised behavioural problems such as hostility, aggression, and defiant behaviour (Rohner & Britner, 2002).

### **2.3.3 Affect.**

Affect is the extent to which a parent's behaviours and communications include acceptance, enjoyment, verbal and non-verbal expression, as well as a range of stimulation and positive attitudes with the child and what the child is doing (Mahoney, 2008). Research has shown that positive affect exhibited by parents during parent-child interaction reinforces and maintains children's engagement in communicative exchanges. For example, during communicative exchanges that involve positive affect (such as self-soothing by singing softly to the child), the parent's responses to the child are likely to model and facilitate development of self-regulation (Bell & Ainsworth, 1972). In contrast, when parents exhibit negative affect such as rejection and dismissive behaviours, these maladaptive communicative exchanges often teach children to minimise, mask, or over-regulate negative emotions instead of expressing or regulating them in an adaptive manner (Cassidy, 1994).

Past research has revealed that children may be more likely to develop behavioural problems with mothers who display higher levels of negative affect or emotions, particularly mothers suffering depressive illness (Goodman & Gotlib, 1999; Karazsia & Wildman, 2009). In contrast, positive affect has been found to be a positive predictor of optimal outcomes such as altruism, more flexible thinking, and better problem-solving skills amongst young children (Isen, 2004). In addition, affect-salient parent-child interaction is likely to foster child motivation to interact and relate to others (Camaioni, Longobardi, Venuti, & Bornstein, 1998; Locke, 1996; Penman, Cross, Milgrom-Friedman, & Meares, 1983).

### **2.3.4 Achievement orientation.**

Achievement orientation is characterised as parent's support and encouragement of sensorimotor and cognitive development through play, guiding, teaching or sensory stimulation (Mahoney, 2008). Goal achievement behaviours involve an integrated pattern of beliefs and attributions that represent specific goals to be

achieved during a task (Ames, 1992; Elmen, 1991). Dweck and Elliot (1983) posit that infants constantly strive to understand and manage their environment during an activity or play. Parent-child interactions which focus on goal achievement foster pleasure directly from engaging in it (Heckhausen, 1982), which in return, promotes the development of a sense of competency or mastery.

Studies have suggested that goal-achievement behaviours are positively associated with children's developmental outcomes such as verbal language and joint attention skills, particularly for children with autism spectrum disorder (Vismara, McCormick, Young, Nadhan, & Monlux, 2013). Some researchers have pointed out that an achievement-oriented teaching style could encourage, foster and support children in their preferred tasks to advance developmental skills (Mahoney et al., 1998). In addition, early research has showed that autonomy support is linked to parents being more achievement oriented in their interaction with their children (Hartup, 1963; McClelland, Atkinson, Clark, & Lowell, 1953; Zigler & Child, 1973).

### **2.3.5 Directiveness.**

Directiveness is another dimension of parenting behaviour which has been linked to children's psychosocial developmental outcomes. Directiveness refers to the parent's use of verbal and non-verbal interactive behaviours, which are repeated to control or regulate the child's behaviour or attention (Chiarello & Palisano, 1998; Marfo, 1992). Research has shown that parents of children diagnosed with expressive communication impairments that are associated with physical and/or neuromotor impairments are more likely to increase their physical directiveness when interacting with their children, particularly those who have lower degrees of motor abilities (Cress et al., 2008). Research has revealed that directive mothers were found to be negatively associated with lower degrees of social problem-solving skills in children (Rose-Krasnor, Rubin, Booth, & Coplan, 1996). Similarly, other studies have demonstrated that children with parents who were less directive and engaged in a facilitative parenting style, combining qualities of parental sensitivity and elaboration of the child's activities or tasks, often displayed higher levels of receptive language and cognitive development (Barnes, Gutfreund, Satterly, & Wells, 1982; Murray & Hornbaker, 1997).

However, the existing literature has shown that directiveness coupled with positive parenting behaviour could have a positive impact on children's developmental outcomes. For example, parents who were directive and responsive, and provided their children with a range of possibilities and choices of activities during a play session, exhibited a type of parenting behaviour which was a positive predictor of expressive and receptive language skills in young children (Hughes, Dote-Kwan & Dolendo, 1999). Similarly, in another study, Herman and Shantz (1983) demonstrated that mothers who are directive not only encouraged problem-solving capabilities, but also provided some measure of control during tasks involved, with mothers teaching their children with intellectual disabilities how to perform a new task (a game called "Etch-a-Sketch"). This raises a question as to whether parents who engaged in directive behaviour with their children might have been miscast as engaging in maladaptive parenting behaviour. More importantly, there seems to be a need to advance our knowledge as to how to capitalise on the unique strength of directive behaviour to facilitate and promote positive parent-child interaction.

### **2.3.6 Disciplinary strategies: punitive, democracy, permissive and autonomy support.**

A group of parenting behaviours that has been repeatedly linked with social outcomes in children are disciplinary strategies such as punitive discipline, democratic discipline, permissive discipline, and autonomy support. Punitive parental reactions to children's emotions have been linked to inappropriate emotional regulation strategies (such as avoidance or revenge-seeking behaviours), antagonism and anger (Eisenberg & Fabes, 1994; Eisenberg, Fabes, Carlo, & Karbon, 1992), and to overall lower degrees of social emotional competence (Jones, Eisenberg, & Fabes, 2002). This is consistent with the assumption that punitive parental responses to children's emotional reactions serve to intensify children's emotional arousal and teach children to avoid and disregard, instead of recognising and appropriately conveying adverse emotions such as distress and rage (Eisenberg, Cumberland, & Spinrad, 1998). Moreover, parents who frequently use power assertive disciplinary strategies tend to have children with less optimal social skills (Hart, DeWolf, Wozniak, & Burts, 1992; Kennedy, 1992).

Democratic discipline has been found to be associated with an authoritative parenting style (Baumrind, 1966, 1967, 1971). Democratic parents often show behaviours that are consistent, responsive, warm and firm, and use inductive reasoning to establish and negotiate disciplinary actions (Baldwin, 1946, 1949). Such bi-directional communication between the parent and child may foster the internalisation of a parent's values and thought processes in the child, which in turn, increases the effectiveness of the parent's disciplinary action and behaviour (Grusec & Goodnow, 1994). Democratic discipline has been positively associated with adolescents' psychosocial development including social skills (Baumrind, 1991; Dornbusch, Ritter, Leiderman, Roberts, & Fraleigh, 1987; Grusec & Goodnow, 1994; Morrison, Rimm-Kaufman, & Pianta, 2003; Shek, Lee, & Chan, 1998; Smetana, 1995; Steinberg, Lamborn, Darling, Mounts, & Dornbusch, 1994).

Permissive parents often display behaviours that permit their children a greater degree of behavioural freedom even though their behaviours may be inappropriate and affect others in a negative manner (Capron, 2004; Reid, 2012). Permissive discipline or inconsistent discipline has been found to be negatively associated with the development of externalising problems in children (Patterson, 1976), as well as the development of an external locus of control (Baumrind, 1997; Deci & Ryan, 1987; Seligman, 1975). Locus of control is characterised as the extent to which a person's attitudes and beliefs allow them to control occurrences that influence them.

Recently, the theoretical approach to parenting behaviour was expanded by Reid (2012) who included an additional parental behaviour, autonomy support, in their self-reported questionnaire (PBDQ). Children's autonomy refers to a child's internalisation of values and guidelines fostered through acknowledgment of their perspectives and feelings, providing appropriate reasoning as opposed to the assertion of power, clear expectations, and providing choices (Deci & Ryan, 2000). Autonomy support has been shown to be negatively associated with internalising behaviours such as anxiety, depression, somatic complaints, and withdrawal (Angold, Costello, & Worthman, 1999; Barber, 1996; Barber, Olsen, & Shagle, 1994; Gray & Steinberg, 1999; Kessler et al., 2006), and externalising behavioural problems such as aggression, hyperactivity and rule-breaking behaviours (Barber, 1996; Card & Little, 2006; Keown & Woodward, 2002; Kincaid, Jones, Cuellar, &

Gonzalez, 2010; Marsee & Frick, 2007) in adolescence. On the other hand, autonomy support has been positively associated with children's motivation, feelings of competence, self-esteem, and academic achievement (Barber, 2002; Elmen, 1991; Grolnick, Gurland, DeCoursey, & Jacob, 2002; Grolnick et al., 1991).

### **2.3.7 Summary.**

Although research has repeatedly demonstrated that different dimensions of parenting behaviours are associated with children's developmental outcomes, it is difficult to draw accurate conclusions due to the inconsistent terminology used for parenting behaviours. For example, some researchers use the same terminology to describe different parenting behaviours (such as parenting control and directiveness), and use different terminology to describe the same behaviours. Parental sensitivity, for example, has been utilised interchangeably with parental responsiveness (Blank, Schroeder, & Flynn, 1995; Drake, Humenick, Amankwaa, Younger, & Roux, 2007; Karl, 1995, De Wolff & van IJzendoorn, 1997; LeCuyer-Maus, 2000; Leerkes, Blankson, & O'Brien, 2009). In addition, it is difficult to draw accurate conclusions due to the inconsistent terminology used for parenting behaviours. Therefore, there is a need to establish a clear construct of parenting behaviour to allow accurate conclusions to be drawn on the relationship between different dimensions of parenting behaviours and developmental outcomes for young children. Importantly, this also enables the facilitation of specific adaptive parenting behaviours to be targeted during intervention. However, research attempting to tease out the dimensions of parenting behaviours has been rare, and there has been limited research that has compared different measurement tools for assessing parenting behaviours.

### **2.4 Approaches Used to Measure Parenting**

Research into parenting reveals that researchers and clinicians have utilised numerous evidence-based measurement tools to assess parenting behaviours and parent-child interactions, and their relation to the child's developmental outcomes. These tools include interviews with primary caregivers, parents and/or children, questionnaires completed by primary caregivers, parents and/or children, and observations which utilise rating scales or checklists applied in the laboratory or at home.

### **2.4.1 Interviews.**

Interviews with primary caregivers, parents and/or children have been used by a number of researchers and clinicians to measure parenting behaviours and parent-child interactions (Grolnick & Ryan, 1989; Quinton & Rutter, 1988; Wootton, Frick, Shelton, & Silverton, 1997). The interview method may be structured, semi-structured, or non-structured and may differ in terms of interview objective and setting, style and theoretical perspective, as well as the number of people being interviewed during the session (Fernandez-Ballesteros, 2004). Interviews also provide sources of information which may not be readily available through observation or testing. When conducting an interview in person, both observational and self-report research methods can be combined, allowing the interviewer to assess verbal responses and behavioural reactions of the interviewee(s).

Structured interviews can be used by researchers and clinicians to obtain direct information about past and current events, as well as clarifying and resolving ambiguous responses, but more importantly, such methods also encourage the interviewee to provide in-depth responses and can elicit spontaneous information (Carlson, 2001; Fernandez-Ballesteros, 2004; Sattler & Hoge, 2006). However, some of the potential difficulties with structured interviews include difficulty in establishing reliability and validity, as these methods can be highly susceptible to bias and error. For example, interviewers may fail to elicit or interpret the information accurately or interviewees may fail to provide accurate information due to personal biases that result in selective attention and recall (Sattler & Hoge, 2006).

### **2.4.2 Parent-reported questionnaires.**

In the context of parenting, researchers and clinicians generally rely on primary caregivers because they are the most reliable person or informant able to provide critical information about their children. Thus researchers and clinicians have repeatedly focused on parents' behaviour towards their child in order to establish the relationship between parenting behaviours and children's developmental outcomes. Parent-reported questionnaires or assessments have been widely used because they are cost-effective in both time and resources, efficient, economical, practical, and can be used on large samples across a wide range of populations (Buri, 1991). This in turn could provide an invaluable, comprehensive, and unique source of information

about the parent's child-rearing behaviour with his or her child. However, parent-reported assessments often fail to document rare phenomena (Bowerman, 1985), and contextual information when required (Gopnik & Metzoff, 1986).

Parent-reported assessments, for example, have been used to determine the association between parenting behaviours and the development of psychopathology such as anxiety, social phobia, and externalising behavioural problems such as aggression and conduct disorders (Aunola & Nurmi, 2004; Lieb et al., 2000; Russell, Hart, Robinson, & Olsen, 2003). Parent-reported assessments are also used to examine the relationship between parenting behaviours and psychosocial aspects such as self-esteem, alcohol and drug use, and academic achievement amongst children (Tam, Chong, Kadirvelu, & Khoo, 2012). However, the effort to determine the association between parenting behaviours and specific developmental outcomes has been hindered due to limited methodologically-sound measurements available to assess parenting behaviours (Essau et al., 2006; Shelton et al., 1996). Further, limited research has been undertaken to determine the relationship between parenting behaviours and children's motor and language development by using parent-reported assessment, particularly in typically developing children beyond the preschool year.

Existing parent-reported assessments are commonly established based on two different levels of analyses: (a) typologies; and (b) dimensions of parenting behaviours. Based on Baumrind's (1966, 1967, 1971) clear and well researched parenting style that derived from typologies (namely, demandingness and responsiveness), the Parenting Authority Questionnaire (PAQ; Robinson, Mandlco, Olsen, & Hart, 1995) consists of three parenting styles that includes the authoritative, authoritarian and permissive. The PAQ was subsequently revised by Reitman, Rhode, Hupp and Altobello (2002), and renamed as the Parenting Authority Questionnaire Revised (PAQ-R). Whilst the PAQ and PAQ-R were developed based on strong empirical evidence, issues with the psychometric properties due to the absence of confirmatory factor analytic data to support the theoretically derived parenting styles have limited the usage of these assessments (Reid, 2012).

Other researchers have developed their assessments based on the theoretically meaningful parenting dimensions that are associated with child behavioural outcomes (Hart, Newell, & Olsen, 2003) such as the Parenting Styles and

Dimensions Questionnaire (PSDQ; Robinson et al., 1995). The PSDQ comprises authoritative, authoritarian, and permissive scales. The authoritative scale yields subscales for democratic participation, good natured/easy going nature, reasoning/induction, and warmth and involvement, The authoritarian scale consists of subscales for directiveness, corporal punishment, non-reasoning/punitive strategies, and verbal hostility. Finally, the permissive scale yields subscales for ignoring misbehaviour, lack of follow through, and self-confidence. The PSDQ is a comprehensive measurement that assesses parenting behaviours (Locke & Prinz, 2002); more importantly, it is one of the few measurements available with psychometric properties associated with parenting nurture and discipline (Winsler, Madigan, & Aquilino, 2005).

However, the PAQ and PAQ-R have been found to be less valid in assessing parenting behaviours of non-Caucasian parents with lower socioeconomic status (Reitman et al., 2002). Similarly, even though Robinson et al. (1995) have attempted to develop the Parenting Styles and Dimensions Questionnaire (PSDQ) using empirical means (factor analysis), other dimensions of parenting such as warmth, that could have a unique influence on the relationship between parenting behaviours and developmental outcomes in children, have not been included.

The Parenting Scale (Arnold, O'Leary, Wolff & Acker, 1993) which is a self-report measure of parenting disciplines is often used to determine the association between dysfunctional parenting disciplines and externalising problems such as aggression and conduct disorders in children. The dimensions of parenting disciplines in the Parenting Scale include laxness, over-reactivity and verbosity. Some researchers have pointed out that other dimensions of parenting, such as warmth, that are not included in the Parenting Scale, might have a moderating effect and unique influence on the relationship between dysfunctional parenting disciplines and psychosocial outcomes (Eisenberg et al., 2005; McCarty, Zimmerman, Digiuseppe, & Christakis, 2005; Rothbaum & Weisz, 1994; Vandewater & Lansford, 1998).

The Alabama Parenting Questionnaire (APQ; Shelton et al., 1996) focused on parenting behaviours such as inconsistent discipline, poor monitoring/supervision, parenting involvement, and the use of positive parenting and physical punishment,

which have been found to relate to externalising problems in children. However, the Parenting Scale and APQ might not be adequate in assessing the relationship between diverse global measures of parenting behaviours and different developmental outcomes in children (Reid, 2012). Moreover, on the APQ, other dimensions of parenting behaviours such as democracy, autonomy support and psychological control have not been included (Reid, 2012).

In addition, the reliability and validity of the existing measures remain unclear because the parenting construct in the Parenting Scale and APQ focuses on a few items when measuring specific parenting behaviours that are of interest (Shelton et al., 1996). For example, parenting behaviours relating to disciplinary strategies have been associated with externalising problems such as aggression and conduct disorders (Aunola & Nurmi, 2004; Russell et al., 2003). In addition, past research in parenting behaviours has focused on family functioning (Epstein, Baldwin, & Bishop, 1983; Moos & Moos, 1981; Roberts, Block, & Block, 1984), the emotional climate in the home environment, and parenting stress and competence, rather than parenting behaviours that are relevant to specific developmental outcomes (Darling & Steinberg, 1993; Frick, 1994).

Recently, the PBDQ (Reid et al., 2012) was developed to overcome some of the limitations associated with existing measurements. For example, some researchers have pointed out that dimensions of warmth, behavioural control, and psychological control, that have been used to describe the core construct of parenting in the past six decades, have been insufficient in capturing the phenomenology of parenting (O'Connor, 2002; Skinner et al., 2005). In addition, Reid et al. (2012) expanded the theoretical approach for parenting behaviour by separating the dimensions of psychological control and autonomy support. Furthermore, the PBDQ included the dimension of psychological control that has been generally omitted by existing assessments. The PBDQ has used rigorous empirical methodologies that covered extensive dimensions of parenting behaviours found in six well established parent-reported questionnaires with children aged three to 12 years.

The initial PBDQ consisted of a 36-item scale that was categorised into six dimensions of parenting behaviours, namely, emotional warmth, punitive discipline, anxious intrusiveness, autonomy support, permissive discipline, and democratic

discipline. However, the dimension of anxious intrusiveness was initially excluded from the assessment when confirmatory factor analysis supported a higher order five-factor solution (Reid et al., 2012).

In the PBDQ, Reid et al. (2012) characterised emotional warmth as the levels of affection and emotional support that parents display with their children, including acceptance, positive affect and receptiveness shown to the child. Punitive discipline is described as degrees of harsh, psychological, and mood-dependent discipline strategies which parents engage in with their children. Autonomy support is characterised by parenting behaviours that are responsive and supportive (scaffolding), whereas permissive discipline (also described as consistency of discipline) characterises laissez-faire parents who show greater levels of behavioural freedom although their behaviours or actions might affect others in a negative way (Capron, 2004). Lastly, democratic discipline describes parents who employed inductive reasoning and explanation when communicating with their children.

Table 2.2 presents different dimensions of parenting behaviours measured by existing parent-reported assessments. Whilst many evidence-based measurements have been developed to assess parenting behaviours, there is lack of agreement amongst researchers and clinicians in relation to a single standard measurement to assess parenting behaviours (O'Connor, 2002; Towle, Farran & Comfort, 1988). Moreover, the choice of measurement(s) depends on the purpose of the assessment as each measurement tool has unique properties, limitations and strengths (Munson & Odom, 1996). Concerns have also been raised by some researchers about the reliability of respondents' self-reports to subjective questionnaires (Rohner & Brothers, 1999).

Table 2.2

*Examples of Parenting Dimensions Measured by Different Assessments*

Scale	Dimensions of Parenting Behaviours
Parenting Authority Questionnaire Revised (PAQ-R)	Authoritative, Authoritarian, and Permissive Parenting
Parenting Scale (PS)	Laxness, Over-Reactivity, and Verbosity
Alabama Parenting Questionnaire (APQ)	Parenting Involvement, Monitoring/Supervision, Inconsistent Discipline, Positive Parenting, and Corporal Punishment
Parenting Behaviours and Dimensions Questionnaires (PBDQ)	Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline, and Democratic Discipline

**2.4.3 Observation methods.**

When assessing parent-child interactions, observational methods can be broadly categorised into two different approaches namely, checklists and rating scales. In recent years, researchers have frequently used checklists such as the Home Observation Measurement of Environment (HOME) inventory (Caldwell & Bradley, 1984). The HOME inventory utilises both interview and the observational methods to measure parenting behaviours (such as emotional support and cognitive stimulation) at home. The HOME inventory is categorised into four different age bands: (a) infants/toddlers consisting of 45 items; (b) preschool/early childhood consisting of 55 items; (c) middle childhood consisting of 59 items; and (d) early adolescence consisting of 60 items. The HOME inventory records the presence or absence of behaviours either during or after one or more sessions of observations,

evaluating parent-child interactions. With the combination of interview and observation, the HOME Inventory has been a reliable measure to assess the extent and quality of encouragement and stimulation available to the child at home (Totsika & Sylva, 2004). Moreover, by asking the primary caregivers or parents to focus on factual information related to a specific task using the combined interview and observation, it is likely to eliminate misinterpretation of the observed parent-child interactive behaviours by interviewer(s) or experimenter(s) (Cox, Hopkinson, & Rutter, 1981). However, the HOME Inventory administration lacks a standardised procedure (Totsika & Sylva, 2004).

Another observational method used by researchers and clinicians is rating scales. Rating scales are defined as a research methodology that requires a rater to rate frequencies, extents, or qualities of an observed behaviour or interaction represented in specific items by assigning a numerical rating for the behaviour (Likert, 1932). Rating scales assess parenting behaviour by grouping specific behaviours under broader categories, and raters are required to rate both the quality and quantity of observed behaviour as it occurs during parent-child interaction (Cairns & Green, 1979; Danforth, Anderson, Barkley, & Stokes, 1991). Rating scales focus on widely defined groups of behaviours such as responsiveness or sensitivity rather than specific behaviours displayed when evaluating parent-child interaction. A period of observation is videotaped at home or in the laboratory, and the occurrence of behaviours during this period is rated by trained rater(s). Rating scales have found a useful niche in the existing literature on parenting behaviour due to their sensitivity in detecting changes in parenting behaviours following intervention (Mahoney, Spiker, & Boyce, 1996).

Some of the advantages of using rating scales include quick and easy administration and scoring (Guilford, 1954; Irwin & Bushnell, 1980), and an equal or higher stability over time when compared to behavioural coding systems (Clarke-Stewart & Hevey, 1981; Schaefer, 1989). In addition, some studies have demonstrated that rating scales have higher levels of predictive validity for later behaviour in comparison to behavioural coding systems (Jay & Farran, 1981; Schaefer, 1989). This may have accounted for the growing interest in utilising rating scales in research on early childhood (McCloskey, 1990).

There are two types of rating scales: (a) molecular coding scales; and (b) molar rating scales. Molecular coding scales involve more detailed recording of occurrences of verbal and non-verbal behaviours during a period of observation (Rosenberg, 1986). An example of molecular coding is the Interpersonal Behavior Constructs System (IBCS; Kogan, 1972; Kogan & Gordon, 1975). The IBCS was developed to evaluate qualitative aspects of parent-child interactions in 23 categories of behaviours. These behaviours are summed and represented by six different qualities of parent-interactions, namely positive affect, negative affect, non-acceptance, dominance, submissiveness, and attention. The IBCS primarily focuses on non-verbal behaviours, positive and negative, including animation, boredom, frowns, laughs, smiles and expressions of frustration. Both the parent's and child's behaviours are assessed separately on the six different qualities of parent-child interactions. Rosenberg, Robinson and Beckman (1984) note that although the IBCS focuses on specific behaviours in evaluating parent-child interaction, parenting behaviour could be difficult to interpret because it might be hard to extract a common meaning (such as animation) from a set of narrowly defined behaviours (such as animated voice). Moreover, when assessing non-verbal behaviours, such observation can be highly susceptible to observer or experimenter bias. To overcome these limitations, some researchers and clinicians have been using a molar rating scale instead to assess parent-child interaction.

One of the advantages of using a molar rating scale is summarising groups of behaviours that are postulated to represent specific qualities of parent-child interactions. For example, in the Maternal Behavior Rating Scale Revised (MBRS-R; Mahoney, 2008), one of the behaviours observed is Responsiveness which is represented by three different observed behaviours, namely, effectiveness, responsiveness, and sensitivity. As suggested by Eyberg and Ross (1978), another advantage of using the molar rating scale includes the elimination of sources of variance such as the influenced of an individual's characteristics or setting. For example, a parent might show a greater degree of sensitivity but less effective and responsive behaviours to a child who is described as temperamentally emotional.

Molar rating scales emphasise the essential meaning of complex events or situations. However, errors in a molar rating scale could occur from a lack of clarity

in the specification of behaviours evaluated, or from observer bias. These limitations can be addressed by using well-defined rating scale points and comprehensive training of the raters. Some of the molar rating scales that have been widely utilised by researchers and clinicians include the Social Interaction Rating Scale (SIRS; Ruble, Heflinger, Renfrew, & Saunders, 2005), Dyadic Parent-child Interaction Scale (DPCIS; Robinson & Eyberg, 1981), and MBRS-R (Mahoney, 2008).

The SIRS was developed to assist parents with children diagnosed with autism spectrum disorder. This measure focuses on behavioural abilities such as initiating, maintaining, and responding to others to promote psychosocial skills amongst children with autism. The SIRS consists of six items that represent parental responsiveness: (a) affect; (b) contingency; (c) directiveness; (d) initiation toward the child; (e) maintenance of interaction with the child; and (f) movement with the child. These behaviours are measured using a five-point Likert scale ranging from 1 to 3, with 0.5 midpoints (such as 1.5, 2.5). A rating of 1 indicates the parent displayed “*a lower degree of responsive behaviour*” and a rating of 3 indicates the parent showed “*a higher degree of responsive behaviour*” with their children. The summation of each of the six items provide an overall score. The SIRS has demonstrated that children with autism display greater levels of initiative during social interactions when their parents show greater levels of engagement (Ruble, McDuffie, King, & Lorenz, 2008). However, the SIRS generalisability is limited as the evidenced-based studies generated by SIRS were only used in clinical settings for intervention with relatively small clinical sample sizes, particularly with autistic children.

The Dyadic Parent-child Interaction Scale (DPICS) is another observational measure is used to assess parent-child interaction. This measure was first developed by Robinson and Eyberg (1981), and subsequently revised and renamed as DPICS II (Eyberg, Bessmer, Newcomb, Edwards, & Robinson, 1994). This measure was developed to measure different qualities of parent-child social interactions. The DPICS II consists of 28 categories of parent behaviours such as contingent praise, indirect command, direct command, criticism, smart talk, play talk, laugh, whine, yelling, and time out. Observations are recorded in three standard settings: (a) child-directed interaction; (b) parent-directed interaction; and (c) clean-up session. One occurrence of behaviour is coded based on observations at five-second intervals. This

extensive measure has been used at home and in laboratory settings. However, training in the use of it may take up to three months due to the large number of observed behaviours (Olson & Foster, 1991).

The MBRS (Mahoney, Finger, & Powell, 1985) was initially developed and used to assess the impact of maternal interactive behaviour in atypically developing children. The MBRS was subsequently revised (the MBRS-R) by Mahoney, Powell and Finger (1986), and Mahoney (2008). In this instance, the specific quality of maternal behaviour observed on the MBRS-R is reliably coded as part of intervention assessment before treatment commenced (Fewell & Deutscher, 2004). The MBRS-R is also used to assess qualities of maternal and child interactive behaviours that are related to a child's developmental outcomes, particularly cognition, motor development, and expressive and receptive language outcomes (Deutscher et al., 2006; Fewell & Deutscher, 2002; Mahoney et al., 1998; Penne et al., 2012). The MBRS-R provides global ratings of 12 qualities of maternal behaviours derived from different global maternal rating scales reported in the existing literature of children's developmental outcomes (Mahoney et al., 1998; Mahoney & Powell, 1988). Through factor analysis, the MBRS-R is conceptualised into four dimensions of parenting behaviours: (a) Directiveness (as measured by directiveness and pace); (b) Responsiveness (as measured by effectiveness, responsiveness, and sensitivity); (c) Achievement Orientation (as measured by achievement and praise); and (d) Affect (as measured by acceptance, enjoyment, expressiveness, inventiveness, and warmth). Parent-child studies using the MBRS-R have consistently demonstrated that by encouraging and supporting parents to respond more sensitively and responsively towards their children, such parenting behaviour could promote children's development growth (Kim & Mahoney, 2004; Penne et al., 2012).

As suggested by Mahoney, Finger and Powell (1985), the MBRS-R is sensitive to parenting behaviours which are statistically related to children's developmental outcomes, and can detect changes in parent's interactive behaviour with their child that have been supported through an intervention program (Deutscher et al., 2006; Mahoney, Wheeden & Perales, 2004). In addition, scores on the MRBS-R have been found to be associated with variability in children's language, intellectual and social

development (Mahoney et al., 1986). Therefore, the MBRS-R has been frequently used by researchers and clinicians in both assessment and intervention in relation to parenting research.

Observational methods have the indisputable appeal of ecological validity and are often considered a direct, objective and reliable method to measure parent-child interaction (O'Connor, 2002). In fact, observing parent-child interaction has been the most frequently utilised approach in parenting research (Forehand & McMahon, 1981; Patterson, 1982). However, such observations are often influenced by the presence of the observer, and the interaction between young children and their parents could be affected by the presence of the observer or a third person (Bornstein, Haynes, Painter & Genevro, 2000; Zegiob & Forehand, 1978). Moreover, behavioural observation is generally more complex, costly, and might not be suitable to assess older children (Essau et al., 2006). In this instance, the ecological validity could be impeded as the reaction to observation appears to increase with the age of the child (Keller, 1986).

Similarly, the structure or content of parent-child interactions may vary when children are playing with their parents as distinct from when they are learning a new task from their parents (Bornstein et al., 1999). Such variance poses a problem in terms of defining and categorising different qualities of parent-child interactions. Furthermore, some researchers argue that interaction between parent and child in a free-play situation in comparison to a structured or semi-structured situation is likely to elicit spontaneous interaction between parents and their children (Gilmore, Cuskelly, Jobling, & Hayes, 2009). These researchers also highlighted that a free-play situation could ensure that activities or tasks are suitable for the developmental levels of different age groups.

Although observational methods are extremely useful in different settings (at home or in the laboratory) in parenting research, they are time and resource consuming to administer and score because they require extensive hours of training (raters) to develop reliability (Munson & Odom, 1996). Despite this limitation, much of the existing literature of parenting behaviour has used the observational method to measure parent-child interactions due to the reliable and credible information

obtained through the standardised training protocol, extensive training amongst raters, and the systematic coding of observed behaviours.

## **2.5 Summary**

The internal working model developed by Bowlby (1973, 1988) supported the notion that direct experience of early parent-child interaction plays a significant role in the development and maintenance of the attachment relationship. More importantly, different qualities of parent-child interactions could be critical mediators in the development of positive emotional skill, cognition, motor and language ability (Bus & van IJzendoorn, 1988; Lemche et al., 2007; Meins, 1998; Spieker et al., 2003; Thomson, 2006; Wintgens et al., 1998). Considerable research into parent-child interactions has focused on the influence on specific developmental outcomes with young children. However, there is a lack of agreement amongst researchers regarding a single, comprehensive and definitive assessment to measure parenting behaviours (O'Connor, 2002).

Moreover, some researchers have pointed out that there is a distinct difference between parenting practices that consists of specific and goal-directed parenting behaviours, and parenting styles where parenting behaviours are expressed in an emotional climate, that is, a range of emotions perceived in others (Darling & Steinberg, 1993). However, researchers have consistently used these terms interchangeably (Maccoby & Martin, 1983) and different research methods have been utilised to measure parenting behaviours. More importantly, this raises an important practical issue related to measuring parenting behaviours and parent-child interactions which has hampered progress in determining the precise relationship between parenting and specific developmental outcomes in children (Essau et al., 2006; Shelton et al., 1996). For example, the dimension of psychological control has rarely been measured although past studies have repeatedly shown that it can significantly influence psychosocial development in adolescents (Grolnick, 2003; Ryan, Deci, Grolnick, & La Guardia, 2006; Soenens & Vansteenkiste, 2010). Such incongruent measures of parenting behaviours may not adequately describe the phenomenology of parenting.

Furthermore, due to incongruent measures of parenting behaviour, it has not been possible to systematically compare and contrast different parenting

measurements, or to define and measure what are the most important dimensions of parenting behaviours. Moreover, Holden (1997) pointed out that parent's adaptation and adjustment to changes in the child or life situations might not be captured by a static approach towards measurement of parenting. Therefore, this warrants further investigation as to how different research methods used to assess parenting behaviours and parent-child interactions could provide practical and reliable information to determine the relationship between parenting and developmental outcomes in young children. More importantly, there is a need to advance our knowledge to identify an empirically robust theoretical framework within the existing parenting models. In this instance, whilst dimensions of parenting behaviours seem to capture some aspects of parenting, researchers and clinicians have yet to come to a consensus in identifying the fundamental dimensions that may represent core parenting behaviours.

# **Chapter 3**

## **Parent-Child Interaction, Motor and Language Development**

### **3.1 Dynamic Systems Theory and Development**

According to dynamic systems theory, children's development can be viewed through mutual, multiple, and constant interaction at all levels of the developing system, including parent-child interaction, language, imitation, social relationships, perception, experience and action, and atypical patterns of developmental changes (Courage & Howe, 2002; Fogel, 2000; Gershkoff-Stowe, 2002; Gogate & Walker-Andrews, 2001; Johnson, 2001; MacWhinney, 1999). Theorists for dynamic systems approach postulate that all children's developmental outcomes can be explained as the natural and spontaneous occurrence of logical, shared interactions of multiple and higher-order components within a task context (Lewis, 2000; Thelen, Ulrich, & Wolff, 1991).

According to principles of self-organisation, behaviours emerge from the interaction of multiple sub-systems within the child, the demand of the task, and the environment (Lewis, 2000; Newell, 1986; Thelen et al., 1991), including experience (Buchanan & Ulrich, 2001). In relation to motor development, Buchanan and Ulrich posit that children's movements or behaviours develop and adapt constantly in the context of current movement tasks. Such adaptability and flexibility could synchronise with stability, in which, movements or behaviours slowly emerge and remain plastic. In return, this plasticity facilitates the utilisation of behavioural patterns that may occur gradually or rapidly (Thelen & Smith, 1994; Ulrich, 1997). Some researchers have also pointed out that emerging behaviours need to be practiced in different environment to facilitate the flexibility of movement patterns (Adolph & Berger, 2006; Heriza, 1991). In order to produce co-ordinated or functional movement patterns, newly acquired behaviours need to be control and maintain in a stable environment. In this instance, through the child's social context (e.g., parent-child interactions), caregivers and parents could provide the necessary opportunities for their children to explore various movement patterns (e.g., a child using all five fingers to grasp an object from his or her parents) that promote and

facilitate functional movement patterns (e.g., pincer grasp that uses only index fingers and thumb to pick up small toys or foods).

Consider, for example, a child learning to ride a bicycle for the first time. The skills required in this case include staying on the bicycle and peddling at the same time. The child not only makes moment-to-moment adjustments in response to the bicycle's movements but he or she will also need to anticipate changes with the speed of peddling and balancing. During these practices, the child experiences two types of information: (1) the interrelationship between body and movements and; (2) the relationship between the child and the environment, in this case, parents' guidance and support toward accomplishing a motor task. Thus behaviours not only emerge from the interaction of multiple sub-systems within the child and task content, more importantly the environment (e.g., parent-child interactions) play a critical role in children's motor development.

Thus far, the dynamic systems theory has led to novel and different accounts of children's accomplishment in classic Piagetian tasks (Thelen et al., 2001), different explanations of social-emotional development (Lewis, 2000), revolutionary suggestions about motor development (Thelen & Ulrich, 1991), as well as fundamental principles in the understanding of children's language development (Bates & Elman, 2000; Elman, 2001). In motor development, for example, recurring interactions amongst muscular and perceptual activities are likely to give rise to patterns of coordination within the multiple sub-systems, which in turn, facilitate infants' motoric behaviours (Kamm et al., 1990; Thelen & Smith, 1994). In this instance, crawling not only involves recurrent patterns of coordination, but the infant also requires adequate strength to undertake a hands-and-knees posture. Over time, the constant recurrent interactions within the multiple sub-systems become more mature, which reinforce and maintain the existing coordinated movements or processes in turn (Haken, 1987). Lewis (2000) also pointed out that over a longer period of time, these recurring interactions become more complex and functional, allowing new movements or behaviours to slowly emerge (e.g., cruising that describes an infant shuffling along while holding onto furniture) that are later replaced by a more efficient movement (e.g., walking without any support).

Similarly, dynamic interactions within the multiple sub-systems can provide an explanation for the emergence of language development in children (Lerner, 2006; Thelen & Smith, 2006). According to dynamic systems theory, comprehension of sentences, for example, is viewed as spontaneous self-organisation which, over time, continues to shift in and out of the unique and different meaning of words (lexical and morphological) and interacts with different comprehension attractors (Evans, 2002). These attractors are processes where different interactions of behavioural modes within the multiple sub-systems occur. As an individual processes a sentence, there are preferred attractors (such as the relative frequency of a word in a particular syntactic group, the local context within the sentence, semantic information about words, and discourse context) to form a sentence (Tabor, Juliano, & Tanenhaus, 1997). Thus stronger attractors will pull the child's comprehension and understanding towards a specific meaning state, whereas weaker attractors will have less influence on the final interpretation of a sentence (Elman, 1995). In addition, stronger attractors require more energy to maintain them in the meaning state when compared to weaker attractors (Thelen & Smith, 1994).

This also provides a possible account of the abrupt reduction of understanding and comprehension capabilities in children with language difficulties (Elman, 2001; Lewis, 2000). For example, when new language emerges, particularly in children with language difficulties, their emerging strategies are less efficient and require more energy to process in order to interpret and comprehend the meaning of a sentence, thus increasing the processing demands (Van der Maas, 1998).

From a biological perspective, Haken (1996) postulated that language input is processed more slowly and less efficiently because the underlying attractors in children with language difficulties become qualitatively different from typically developing children. When interpreting a sentence, children with language difficulties require more energy to process and maintain the sentence in working memory, increasing external processing demands. When the external processing demands exceed the capacity of the child with language difficulties, this will affect the real-time language processing, but more importantly, such process deficiencies will have a constant influence on the shaping of language, and may result in a failure

to shape the fundamental representation of language for the child with language difficulties (Evans, 2002).

One plausible explanation as to why motor development could play a significant role in the relationship between parent-child interactions and language development is supported by dynamic systems theory. According to dynamic systems theory, small but critical changes (such as parenting behaviours that are responsive and warm) in one sub-system may result in large change in children's developmental outcomes such as motor and language skills (Browman & Goldstein, 1993; Lerner, 2006; Thelen, 1995; Thelen & Smith, 2006). Moreover, these changes in development are not solely dependent on the maturation of the central nervous system, but instead on the interaction of multiple sub-systems within the child, the environment, and the demands of the task (Newell, 1986).

Therefore motor skills not only foster positive interactions between parents and their children (Tamis-LeMonda & Bornstein, 2002), some researchers have pointed out that children's motor skills might provide the opportunities for children to develop and acquire language skills (Karasik et al., 2008). Drawing, for example, can be used as a visual communication for a child to represent and render what they know about an object or word, which in turn, provides the learning opportunities for children to express and understand meaning of a word (Freeman, 1993; Thomas & Silk, 1990). If this assumption is deemed to be true, dynamic systems theory not only provides an explanation for the emergence of development in young children, it also supports the notion that different dimensions of parenting behaviours may have a significant role in children's developmental outcomes.

### **3.2 Parent-Child Interaction and Children's Language Development**

Parents are the centre of an infant's world because they are the most important source of nurturing, safety, sustenance, and learning opportunities. In the context of parent-child interaction, parents are the most important partners for infants because they spend a substantial amount of time in the child's early social interaction, particularly during feeding and play time. For example, during play sessions, specific elements that contribute to different qualities of parent-child interactions derive from the individual behavioural repertoires of both child and parent. Reciprocity develops as both partners learn to respond and adapt to one another. Parent-child interaction

can also be motivated by a concern to direct the child's behaviour, and more importantly, such an interaction can engage the child in conversation which may facilitate and support the child's language and intellectual development (McDonald & Pien, 1982). Consistent with this assumption, past research has revealed that day-to-day parent-child interaction contributes to the emergence of expressive and receptive language skills amongst young children (Barnett, Gustafsson, Deng, Mills-Koonce, & Cox, 2012).

Different qualities of behaviours that parents engage in with their children could also provide opportunities for their children to practise emerging skills, and to elaborate existing behaviours. For example, as suggested by Iverson (2010), highly responsive parents are more likely to respond to their infant's crying by offering soothing vocalisations, warmth and affection, which in turn, soothes the infant. These repeated behaviours are the foundation of the relationship between an infant and a responsive parent, and more importantly, these highly responsive parent-child interactions change over time with development. In addition, parents who engage in positive interactional behaviour with their children created through such social contexts could help their children learn and acquire important attributes of language including vocabulary and semantic relations, which in return expand their interactional repertoires (Fewell & Deutscher, 2004).

Research into the association between parent-child interaction and children's language development has been well-documented. Different qualities of parenting behaviours such as responsiveness (Karrass & Braungart-Rieker, 2003; Mistry et al., 2004; Tamis-LeMonda et al., 2001; Tamis-LeMonda, Kuchirko & Song, 2014), affect (Bloom & Beckwith, 1989; Bloom, Beckwith, Capatides, & Hafitz, 1988; Kubicek & Emde, 2012), achievement orientation (Vismara et al., 2013), directiveness (Barnes et al., 1982; Hughes et al., 1999; Murray & Hornbaker, 1997), warmth (Perkins, Finegood, & Swain, 2013), and parental disciplinary strategies involve punitive discipline, intrusiveness and controlling (Tamis-LeMonda, Shannon, Cabrera & Lamb, 2004; Taylor, Donovan, Miles & Leavitt, 2009) have been consistently identified to foster and facilitate children's language development.

More specifically, parental responsiveness that foster interactive engagement between the parent and child has been found to have positive effects on children's

expressive and receptive language (Landry, Smith, Swank, Assel, & Vellet, 2001; Lomax-Bream, Taylor, Landry, Barnes, Fletcher, & Swank, 2007; Magill-Evans, 1999; Masur et al., 2005; Warren, Brady, Sterling, Fleming, & Marquis, 2010). Some researchers have suggested that parental positive affect may foster and reinforce interactions with children's social and linguistic development, particularly with typically developing early talkers (Kubicek & Emde, 2012). In this case, parental positive affect is more likely to promote parent-child interactions, which in turn, increase the child's opportunity and exposure to language input. Other research (Taylor, Donovan, Miles & Leavitt, 2009) has found that there is a significant relationship between children's language attainment and maternal control strategies that involves guidance, control and negative control. In particular, children's language acquisition appears to be lower when mothers engage greater levels of prohibitions and commands with their children. Authoritative parents are also found to be associated with children who are more socially competent, and have higher academic achievement and language attainment (Steelman, Assel, Swank, Smith & Landry, 2002; Taylor et al., 2004).

Whilst the existing literature has widely documented the association between parent-child interaction and language development in children, it also raises several important questions. For example, in a large longitudinal study that consisted of 1,097 childcare providers and mothers (either examined independently or jointly), Hirsh-Pasek and Burchinal (2006) examined whether childcare providers and mothers who are sensitive with their children could influence the children's language and academic achievement over time. An unstandardised measure was used to assess parent-child interaction. Although Hirsh-Pasek and Burchinal's (2006) study showed that parent-child interaction was a significant predictor of children's language and academic skills, several limitations were observed.

First, different scoring systems were used to measure the mother's sensitivity. At six, 15 and 24 months, sensitivity was measured using the mean of a four-point ratings scale measuring: (a) maternal stimulation; (b) maternal sensitivity to child non-distress; (c) intrusiveness; and (d) positive affect. At 36 and 54 months old, and when the child was in first grade, sensitivity was measured using the mean of a seven-point ratings scale (prorated to the four-point ratings scale by multiplying by

4/7): (a) maternal stimulation; (b) supportive presence; (c) hostility; and (d) respect for autonomy. In addition, the rating of maternal stimulation was scored as the number and quality of tasks or activities supposed to enhance cognitive, linguistic, perceptual, and physical development. These different rating scales used in Hirsh-Pasek and Burchinal's (2006) study might pose a validity issue for the study. For example, past research (Guyatt & Jaeschker, 1990; Linacre, 2002) has demonstrated that a broader rating scale would increase the sensitivity of the measure. Sensitivity refers to the probability that the measurement tool will detect a true change in the domain being measured. Furthermore, the inconsistency of the rating scale might also inflate the statistical significance of this study.

Second, an explanation was not provided in the rationale as to why different behaviours were used in the construction of maternal sensitivity. Third, parent-child interactions were observed in two different settings: at the child's home and in the laboratory. Because of the variability with unstandardised settings, this could have elevated the variability amongst raters and contexts of interactive behaviours observed when coding these interactions. Fourth, a semi-structured play session observed in this research may not elicit spontaneous or natural responses between mothers and their children, particularly in the laboratory setting. Lastly, free play situations are possibly a well-established pattern of interaction rather than a predetermined structured situation (Gilmore et al., 2009).

In another longitudinal study that consisted of 49 healthy preterm children and their mothers and 54 full-term children and their mothers, Magill-Evans and Harrison (1999) used naturalistic observation to examine the relationship of father-child and parent-child (both fathers and mothers) interaction, perceptions of parenting stress, family characteristics (child's gender and socioeconomic status), mental and motor development, and expressive and receptive language attainment at three, 12 and 18 months. Both father-child and parent-child interactions were observed at home separately by an observer for approximately one hour using the Nursing Child Assessment Teaching Scale (NCATS; Sumner & Spietz, 1994). The NCATS consists of 73 behaviours scored as observed, or not observed, categorised into two scores: (a) Parent's score (response to distress, nurturing of socio-emotional, nurturing of cognitive growth, and sensitivity to prompts); and (b) Child's score (clarity of cues

and responsiveness to parents). The results demonstrated that the NCATS score for mother only, infant gender, and socioeconomic status accounted for 17% of variance in infant's mental and motor development at 12 months. Also, characteristics of mother, father and child could be explained by 22% variance of infant's receptive language attainment.

Magill-Evans and Harrison (2001) followed up 93 (44 families with children born preterm and 54 families with children born full-term) participants from their previous study close to the child's fourth birthday. At this time the relationship of both paternal and maternal behaviour, perceptions of parenting stress, couple relationship, and family characteristics (child's gender and socioeconomic status), to expressive and receptive language attainment were examined. The Dyadic Adjustment Scale (Spanier, 1989) was added to this study to assess a couple's relationship. A second home visit was conducted close to the child's fourth birthday to observe both father-child and parent-child interaction. These observations were carried out separately at home by a different observer from the previous study. Parent-child interactions were rated using the NCATS (Sumner & Spietz, 1994). The results showed that both parenting stress and father-child interaction at 12 months accounted for 19% of the variance in expressive language acquisition for both preterm and full-term children. Also the results indicated that both the mother's spousal relationship and parent-child interaction at 12 months accounted for 13% of the variance in children's receptive language acquisition.

Whilst the Magill-Evans and Harrison (1999, 2001) studies indicated that both paternal and maternal behaviour played a significant role in children's language acquisition, several questions remain unclear. Although careful consideration had been taken when observing parent-child interaction (including order of observation was reversed, mother first then followed by father, and using a naturalistic setting), the content of the parent-child interaction could be influenced by the presence of the observer (Bornstein et al., 2000; Zegiob & Forehand, 1978), and parents were observed teaching the child a structured task (Gilmore et al., 2009). Second, if maternal behaviour changed over time as suggested by some researchers (Hirsh-Pasek & Burchinal, 2006; Vaughn, Egeland, Sroufe, & Waters, 1979), it is likely that when children acquire more words, then the extent and strength of their semantic and

language knowledge increases (Landauer & Dumais, 1997). This might provide more conversational interactions with their mothers, which would have a significant impact on their language development in turn. Moreover, some researchers (Hollich et al., 2000) postulate that language acquisition involves processes such as cognitive limitations, social-interactive influences, and attention mechanisms where children use these available inputs differently across various developmental stages. However, past studies have focused predominantly in infants and toddlers.

Lexical development, that is, the specific meaning relative to a spoken language related to world knowledge, is acquired by children throughout their school years. This aspect has not been explored by Magill-Evans and Harrison (1999; 2001) as their study only accounted for children up to four years old. Crais (1990) argued that children's language development is related to world knowledge, which develops rapidly throughout the school years. For example, past studies have revealed that different socioeconomic status and mother education significantly impacted the child's verbal and reading outcomes (Fewell & Deutscher, 2004; Hart & Risley, 1995; Walker, Greenwood, Hart, & Carta, 1994). In this instance, the impact of the mother's educational background could have increased their experience of school successes, which in turn, increases their ability to help the child adapt to school expectations. However, very little is known about the impact of parent-child interaction on developmental outcomes beyond preschool, as existing studies commonly employed children from birth to 54 months. Third, although studies of parent-child interaction show that both parents could play a significant role in language development, some researchers have pointed out that there are qualitative differences with mother-child interactive behaviour when compared to father-child interactive behaviour (Lindsey & Caldera, 2006). For example, some studies have revealed that mothers spend more time in care-taking and they often employed toys, and verbal and non-physical style of play, whereas father-child interactions are more playful and exhibited a more physical style of play (Belsky, 1979; Clarke-Stewart, 1978; Lamb, 1977, 1978; Stuckey, McGhee, & Bell, 1982).

Taken altogether, research has identified a relationship between parent-child interaction and the child's language attainment, although it appears that further investigation is needed to address some of the limitations which have been discussed.

Moreover, even though existing literature has consistently demonstrated that parent-child interaction plays a significant role in children's developmental outcomes, very few, though notable studies, have been conducted to determine the linkage between parent-child interaction and motor development.

### **3.3 Parent-Child Interaction and Children's Motor Development**

According to Piaget (1952), at the initial stage of infancy also known as the sensorimotor stage, infants' knowledge and understanding of their immediate surroundings are limited to their sensory perceptions and motor activities. This notion is supported by some researchers (Adolph, Tamis-LeMonda, & Karasik, 2010; Iverson, 2010), where they pointed out that an infant's motor actions and behaviours could be a driving force in his or her social and emotional development. For instance, primary caregivers or parents often use interactive behaviours to attract, foster or engage an infant's attention, which in turn, supports early achievement of motor milestones including crawling, reaching, unsupported sitting, and walking. Further, recent studies reveal that early motor milestone achievement is one of the critical periods in the developmental process, and more importantly, such achievement could provide infants with the opportunities to learn and practise skills which are crucial to later motor development (Iverson, 2010).

Throughout the child's developmental stages, caregivers or parents would continue to exert a direct influence on motor development. This is because when parents provide their children the opportunities to learn and practice fundamental motor skills, this in turn, allows them to acquire, refine and master their motor skills to more complex movements. For example, when a child have mastered his or her basic skills such as jumping and running, these movements would be essential to learn other movements or tasks such as sports activities (e.g., playing soccer that requires a child to run and kick a ball simultaneously). Therefore, children with parents who are responsive, for example, are more likely to be more involved, which in turn, provides their children with the motivation and experience to master their motor skills.

This is consistent with existing research findings that suggests positive parent-child interactions could have a significant influence on a child's motor skill attainment, particularly for atypically developing children (Cress et al., 2008;

Lomax-Bream et al., 2007; Treyvaud et al., 2009). For example, in a study conducted with 27 mothers and their children (mean age of 17.5 months) diagnosed with expressive communication impairments associated with physical and/or neuromotor impairments, Cress et al. (2008) investigated the relationship between parent-child interactions (as measured by directiveness and contingency) and the child's developmental outcomes (as measured by motor and language attainment). Parent-child interactions of between 2.30 and 22.30 minutes (averaged 10.70 minutes) were videotaped at home. Each session consisted of mother-child dyads engaged in various structured and free-play activities. Parent-child interactions were coded at each 15-second interval. The results indicated that there was an association between maternal directiveness and the child's gross motor skills including rolling, crawling and walking independently from both observation and parent report. More specifically, greater levels of maternal directiveness were related to higher levels of gross motor attainment. Although this study supported the assumption that parent-child interaction played a significant role in atypically developing children's motor attainment, variations in the length of parent-child interactions and different types of interactions (structured versus free play activities) could have affected the resultant findings (Bornstein et al., 1999; Cress et al., 2008; Gilmore et al., 2009).

In another longitudinal study carried out by Lomax-Bream et al. (2007), 74 typically developing children and 91 children with spina bifida meningomyelocele, aged six to 36 months, and their mothers, were employed to examine the relationship between parent-child interactions (as measured by warmth, responsiveness and maintaining attention), fine and gross motor skills, as well as early development of cognitive, language and daily living skills. Parent-child interactions were videotaped at the laboratory and evaluated based on an unstructured free play that lasted approximately 15 minutes. Evaluation of parent-child interaction consisted of the last 10 minutes of the video recording to allow parent-child dyads to become comfortable with their surroundings in the preceding time period. The findings revealed that a greater quality of maternal behaviour was associated with higher levels of cognitive and language skills for both groups. However, for daily living skills, greater quality of maternal behaviour (warmth, responsiveness, and maintaining attention of the child) was a positive predictor for the typically developing group. Moreover, maternal behaviour was a significant moderator in the early development of

cognitive, language and daily living skills, even when motor scores were controlled across all three developmental domains. Although the results showed that maternal behaviour towards their children played a significant role in the child's early development, generalisability is limited due to the small and homogenous sample size employed in this study. Moreover, ecological validity in this study is limited because interactive behaviours observed between parents and their children were recorded in the laboratory setting rather than a more naturalistic environment such as the home (Darling & Steinberg, 1993).

In another cross-sectional study, Treyvaud et al. (2009) recruited 152 very preterm children (<30 weeks' gestation or <1250 g birth weight) aged two years and their primary caregivers or parents. They examined the relationship between parent-child interactions (as measured by positive affect, negative affect, facilitation, intrusiveness/over-controlling, and synchrony), and developmental outcomes (as measured by motor skills, cognition, and socio-emotional states). Parent-child dyads completed three structured tasks which took about 10 minutes. Each parent-child interaction was recorded through a one-way mirror in the laboratory. The resultant findings showed that higher degrees of parental positive affect, sensitivity and synchrony were associated with greater socio-emotional competence and cognition. The results indicated that higher levels of parental negative affect were negatively associated with motor development. Although this study provides the supportive evidence for different parenting behaviours being associated with different developmental outcomes, family characteristics such as socioeconomic status, parent's educational level and ethnicity that could have a significant impact on parenting behaviours, were not controlled (Tamis-LeMonda et al., 2008; Topping et al., 2011). Moreover, the parent-child interaction might not be an accurate representation of the actual dyadic interactions because the laboratory setting may inhibit or restrict normal behaviours usually observed at home (Gilmore et al., 2009). It also raises the question of whether interactive behaviours or caregiving relationships displayed across primary caregivers, mothers and fathers could be different (Chiarello, Huntington, & Bundy, 2006; Ganadaki & Magill-Evans, 2003; Tomasello, Conti-Ramsden, & Ewert, 1990). For example, past research has shown that mothers were observed to be more responsive when compared to fathers during free play session (Chiarello et al., 2006).

Kim and Mahoney (2004) conducted a study that consisted of mothers and their atypically developing children ( $n = 13$ ) diagnosed with motor skill disorders, pervasive developmental disorders, and intellectual disabilities, and typically developing children ( $n = 17$ ), with an average age of four years and four months. The results revealed that mothers with atypically developing children exhibited higher levels of directiveness and lower levels of responsiveness and affect, when compared to mothers with typically developing children. In another study that employed 38 mothers and their children with motor delays, aged six to 34 months, Chiarello and Palisano (1998) examined the relationship between mother-child interactions and motor attainment by implementing a home-based physical therapy. Participants were assigned to three different groups where 26 children were receiving centre-based physical therapy, five children in the experimental group, and seven children in the control group. Results revealed that mothers who were more sensitive when interacting with their motor delayed children showed greater levels of physical activities (such as the child's locomotion including cruising and crawling) that could have a significant impact on the children's motor attainment (Chiarello & Palisano, 1998).

Whilst evidence into the relationship between parent-child interactions and children's motor development derives primarily from research work with atypically developing children in their infancy and toddlerhood, the influence of parenting behaviours with typically developing children remains an important issue. This is because existing literature has been focusing only on three different qualities of parenting behaviours, namely, parental responsiveness, warmth and directiveness in relation to children's motor development. In this instance, parental responsiveness and warmth have been found to facilitate and promote children's motor skills (Lomax-Bream et al., 2007; Treyvaud et al., 2009), and in reverse, parental directiveness has been found to be detrimental to children's motor development (Mahoney, Robinson & Fewell, 2001). This raises questions about how different qualities of parenting behaviours might affect children's developmental outcomes. Moreover, some researchers have pointed out that parenting behaviour is multifaceted (Martin, 1989), thus different parenting behaviours are commonly used concurrently with one another. Thus, investigating parent behaviours is important

because it could provide information on the implications of specific parenting behaviours that could support and facilitate children's motor outcomes.

### **3.4 Links between Motor and Language Development**

Some researchers have pointed out that the relationship between motor and language outcomes could be linked by shared underlying neural processes such as the cerebellum, particularly in the role for visual spatial function or visually guided movement (Attig et al., 1991; Botez, Gravel, Attig, & Vezina, 1985; Bracke-Tolkmit et al., 1989; Petrosini, Leggio, & Molinari, 1998; Wallesch and Horn, 1990), and coordination of sequential movements (Halsband, Ito, Tanji, & Freund, 1993; Kelso, 1997; Picard & Strick, 2001; Simmonds, Pekar, & Mostofsky, 2008). Jäncke et al. (2007) have also demonstrated that motor and language functions share identical neuroanatomical foundations, particularly the left-hemispheric region that supports both motor and language acquisitions. This is consistent with numerous studies that found evidence for the proposition that motor and language development in young children could be related (Campos et al., 2000; Iverson, 2010; Viholainen et al., 2006; Vukovic et al., 2010; Wang et al., 2014).

During infancy, significant changes in the ways infants move their bodies when interacting with their environment could have a significant impact on the development of skills and experiences; this in turn, plays a significant role in the emergence of communication and language (Iverson, 2010). Changes in motor skills such as achievements and advances in posture, independent locomotion and object manipulation, provide infants with the opportunity to acquire, practice and refine these motor skills that could in turn, contribute directly and indirectly to the development of language and communication with the world around them (Iverson, 2010). Similarly, infants use their hands and arms to produce early sign production (Meier, Mauk, Cheek & Moreland, 2008). Iverson (2010) also posits that the linkage between rhythmic arm movement and the onset of babbling with infants, as well as the link between changes in infants' skills in object permanence with the emergence of first words, could support the notion that early motor acquisition provides infants the opportunity to practise skills that are relevant to language acquisition.

Some researchers postulate that the frequency of rhythmic arm movements such as banging, shaking, and swinging would co-occur with the onset of babbling in

young infants (Eilers et al., 1993; Oller et al., 1999). Rhythmic arm movements may provide infants with the opportunity to link their movements with the resultant sound patterns of their babbling. Therefore, rhythmic arm movements that involve motoric behaviour could provide infants with the opportunity to coordinate their movement, vision, and hearing to create rhythmically organised vocalisations in return. Iverson (2010) proposed that such multimodal feedback could significantly change how infants react and interact with their environment. Iverson (2010) added that newly acquired motor skills not only changed the infants' experience with objects and people around them, more importantly, the emergence of new motor skills could support both communication and language development. Iverson (2010) views language development in the context of our body where the developing language system occurred. This is consistent with the dynamic systems theory whereby multiple sub-systems interact within the child (rattling of toy and reduplication of "bababa" for example), allowing small but critical changes in one sub-system, which in turn, facilitate language outcomes (Lerner, 2006; Thelen, 1995; Thelen & Smith, 2006).

Similarly, object mouthing could also play a significant role in infants' exploration of their own vocalisations (Fagan & Iverson, 2007). For example, infants' early onset production of vocalisations that co-occurs with their mouthing of objects (motoric behaviour) is likely to contain a greater variety of consonant sounds, leading to their early utterances. Other research findings (Mundy et al., 2007) revealed that children's early social communication emerged from three distinct manual-motor skills, namely non-verbal requesting (reaching for a teddy bear), initiating joint-attention (pointing to a teddy bear), and responding to joint-attention (turning one's head in a solicited direction). Similarly, research findings have demonstrated there are significant associations between early oral and manual-motor skills and later speech fluency, particularly in predicting autistic children's speech development (Gernsbacher, Sauer, Geye, Schweight, & Goldsmith, 2008).

With the onset of crawling, Campos et al. (2000) postulate that the emergence of joint attention (infant's ability to follow eye gaze and pointing directed to distal objects) can be partly attributed to gross motor attainment (pointing with gesture). In addition, when parents see this major developmental milestone (infants crawling for

the first time), it is an intense source for social interactive behaviours between parents and children, which in turn, increases parent-child interactions such as verbalised affect, warmth and responsiveness. Together with the onset of new independent motor attainment, infants begin to explore their surroundings, gaining new experiences attending and interacting with distal objects and people around them.

Recently, in a population-based study conducted by Wang et al. (2014), children's early motor skills at 1½ years were found to be a significant predictor of later language outcomes at the aged of 3 years. Consistent research findings have also demonstrated that there is a commonality of co-morbidity in children with language disorders and motor impairments (Adi-Japha et al., 2011; Hill, 2001; Jäncke et al., 2007; Rechetnikov & Maitra, 2009; Ullman & Pierpont, 2005; Webster et al., 2005; Wisdom et al., 2006). For example, in a study conducted by Viholainen et al. (2006), early motor development and later language and reading skills were assessed in 79 typically developing children, and 75 children at risk of familial dyslexia, aged three years and six months, five years or five years and six months, and seven years respectively. The results showed that children at risk of familial dyslexia had lower levels of motor and vocabulary attainment when compared to typically developing children. More importantly, the study demonstrated that early motor development was a significant predictor of children's later reading skill. However, it is noted that one of the environmental factors, namely parent-child interactions that could support early children's motor and language development, was not considered. In this instance, children with motor difficulties may struggle to convey and understand feelings and intentions of others, limiting their capability and opportunity to interact with others in return. Over time, this limitation may lead to failing to understand and respond appropriately to the comments and requests of others, which in turn can affect later language attainment.

Vukovic et al., (2010) employed 30 typically developing children and another 30 children with Specific Language Impairment (SLI) aged four to seven years to investigate the difference between motor and language acquisition in both groups. The results revealed that children with SLI had significantly more difficulties in both motor and language development. More importantly, the findings also indicated that

motor and language acquisition were correlated for both typically developing children and children with SLI. This notion is supported by researchers where they have consistently demonstrated that there is co-morbidity in children with SLI and motor difficulties (Hill, 1998, 2001).

Interestingly, some researchers have also demonstrated that there is co-morbidity in children with SLI and developmental coordination disorder (DCD; Flapper & Schoemaker, 2013; Scabar, Devescovi, Blason, Bravar, & Carrozi, 2006). Children with DCD are marked by difficulties in motor coordination that restrict them in day-to-day tasks related to motor activities, including sports, play and self-care skills, and/or academic achievement including poor handwriting (Smits-Engelsman, Niemeijer, & van Galen, 2001). More importantly, children with DCD often exhibit lower degrees of perceptual organisation, visual inspection, verbal comprehension, receptive and expressive language (Dyck & Piek, 2010). Research has also shown that language impairment is a common co-morbidity in children with DCD, particularly in expressive language, such as lower scores for verbal memory and storytelling (Archibald & Alloway, 2008).

Early researchers pointed out that the cerebellum has been one of the key contributors in the acquisition of motor skills. It has connections to the motor cortex, the skeleto-muscular system, and the sensory processes (Albus, 1971; Ito, 1984, 1990). Recent research has also shown that the cerebellar impairment hypothesis may account for delays in global development, cognition, expressive language, as well as gross and fine motor function in young children (Bolduc et al., 2012). Consequently, it is possible that slow neurocognitive processes attributed to cerebellar impairment could explain the relationship between motor and language development. In this instance, poorer or delayed motor development during infancy, for example, could lead to poor responsiveness to early communications including development and maintenance of joint attention (Warren & Brady, 2007; Warren et al., 2010). These early developmental interactions could constrain or hinder language emergence, which in turn, manifests in limited vocabulary and shorter sentences as the child develops, particularly in children with specific language impairment and developmental coordination disorder (Archibald & Alloway, 2008; Bishop, 2002; Bishop, Adams, & Rosen, 2006; Flapper & Schoemaker, 2013; Hill, 1998, 2001).

In short, studies have shown how an infant's motoric behaviour can provide them with the opportunity to learn essential skills relevant to later language attainment (Campos et al., 2000; Gernsbacher et al., 2008; Iverson, 2010; Mundy et al., 2007; Viholainen et al., 2006; Vukovic et al., 2010; Wang et al., 2014). Such reactions and interactions with their environment could influence the development of skills and experiences in infants, playing a significant role in the emergence of later language attainment in return (Iverson, 2010). More importantly, consistent research has shown that there is a significant correlation between motor skill difficulties and language impairment, particularly in children with DCD (Archibald & Alloway, 2008; Dyck & Piek, 2010).

### **3.5 Summary**

Although the existing literature supports the notion that motor difficulties could co-exist with normal or poor language development in both typical and atypically developing children, it is not well understood how this linkage relates to other contributing factors, particularly when parent-child interaction is one of the important aspects in the child's development process. Furthermore, it appears that some of the questions arising from the existing literature warrant further investigation. For example, there has been a lack of standardised protocols used amongst researchers and clinicians when observing parent-child interactions. This includes the use of different rating scales (four-point ratings scale versus a seven-point ratings scale), constructs of parenting behaviour not being clearly defined, different settings used (laboratory and the home), and inconsistent types, content, and length of tasks involved. This suggests several potential issues such as ecological validity and reliability, but more importantly, the results obtained may not adequately or accurately describe relevant parenting behaviours. Taken together, the aforementioned studies have provided evidence in support of the proposition that there is a possible link between parenting, and motor and language development. Nonetheless, there has been limited research undertaken to examine the causal relationship between parenting, and motor and language development, particularly with typically developing children beyond the preschool year.

## **Chapter 4**

### **Research Rationale, Aims and Significance**

Numerous studies have supported and demonstrated the extent to which a parent supports and guides his or her child's actions and behaviours may contribute to the shaping of their development, including motor (Cress et al., 2008; Lomax-Bream et al., 2007; Treyvaud et al., 2009) and language development (Hirsh-Pasek & Burchinal, 2006; Magill-Evans & Harrison, 1999, 2001). More importantly, in recent years, some researchers (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Mundy et al., 2007; Oller et al., 1999) have demonstrated that motoric behaviour could provide children with the opportunity to learn essential skills relevant to later language attainment, suggesting that there might be a significant relationship between motor and language development in young children. Past research has also shown that there is commonality of co-morbidity in children with language disorders and motor impairments (Adi-Japha et al., 2011; Hill, 2001; Jäncke et al., 2007; Rechetnikov & Maitra, 2009; Ullman & Pierpont, 2005; Webster et al., 2005; Wisdom et al., 2006).

Children in preschool years are characterised by striking changes and advances in language acquisition, psychological and physical maturation such as motor control in both their fine motor (e.g., writing and tying shoes laces) and gross motor (e.g., running and climbing) skills. With a rapid increment in a child's language and motor acquisition during this period, parental behaviours and reactions to these changes are likely to expand and increase the gradual transition of existing skills to become finely-tuned, continuous pattern. Researchers and clinicians have consistently pointed out the critical role played by the interrelatedness of different developmental domains such as children's motor and language acquisition (Alcock, 2006; Alcock & Krawczyk, 2010). Having an understanding of the interrelatedness of different developmental domains could prepare parents and caregivers to support and prepare their children to deal successfully with the challenges of more complex developmental advances.

In addition, although parenting behaviours appear to play a critical role in children's motor development, particularly providing the necessary experiences for the child to acquire and master his or her motor movements, research into parenting

behaviours and motor development has been primarily focused on atypically developing children in their infancy and toddlerhood. Moreover, very little is known about how different qualities of parenting-behaviours could have a different impact on children's motor and language abilities. This is because existing literature has mainly focused on the relationship between parental responsiveness and children's motor and language development rather than other quality of parenting behaviours (e.g., warmth, affect, achievement oriented and disciplinary strategies) that might influence children's motor outcomes. Furthermore, some researchers have pointed out that the parent-child interaction exerts a significant influence on children's developmental outcome over time (Bornstein et al., 1999; Wakschlag & Hans, 1999). Therefore, research is needed in normative samples beyond the first few years because it is unknown whether the relationship between parent-child interactions, early motor and language development persists as the child ages.

The dynamic systems theory proposes that developmental outcomes in children are affected by the interaction between processes of self-organisation and the environment, such as parental input, in shaping behaviours. That is, changes in motor and language development are not dependent merely on the maturation of the central nervous system, but instead on the interaction of multiple sub-systems within the child, the environment and the demands of the task (Newell, 1986). The emergence of developmental outcomes is not constant, and critical changes in one sub-system can result in a large change in the child's functioning over time (Thelen, 1995). Therefore, it is plausible that constant changes are influenced by the quality of parents' behaviours with their children, which in turn, affects their developmental outcomes. Although studies have been conducted to tease out the common occurrence of motor and language difficulties amongst atypically developing children, the causal pathways that link parent-child interaction, and motor and language development in typically developing children, remain poorly understood. More importantly, it is not well understood which of these relationships influence one another and how.

For example, if parents employ strategies of interaction or communication that involve greater degrees of warmth and responsiveness, it is plausible that such positive parent to child interactive behaviours would enhance the child's reactions or

responses with their parents. In turn, this could facilitate and promote children's motor development, and subsequently enhance their language outcomes. This assumption is supported by research findings demonstrating that when parents were directive with their atypically developing children, their children displayed greater levels of cognitive, language, and social emotional functioning (Barnes et al., 1982; Hughes et al., 1999; McCullom & Hemmeter, 1997; Murray & Hornbaker, 1997). Therefore, the primary aim of this thesis is to examine the possible linkages between parent-child interactions, and motor and language development in typically developing children aged four to six years. More specifically, this thesis aimed to provide preliminary evidence about the possible causal relationships between these domains of development.

Much of the research in parenting has stemmed from Baumrind's parenting style (1966, 1967, 1971) based on typologies of demandingness and responsiveness in conceptualising the core parenting behaviours. However, some researchers posit that parenting style might not adequately recognise other underlying parenting features that could contribute to the relationship between parenting behaviours and developmental outcomes in young children (Holden, 1997; O'Connor, 2002; Reid, 2012; Skinner et al., 2005). For example, the dimension of psychological control has been rarely measured in parenting behaviours (Reid, 2012) although early research has revealed it plays a significant role in psychosocial development such as individuation in adolescents (Grolnick, 2003; Ryan et al., 2006; Soenens & Vansteenkiste, 2010).

More importantly, limited research has been undertaken to determine whether dimensions of parenting behaviours should be categorised as multiple correlated dimensions (e.g., parents who are responsive often employ positive behavioural control strategies; Caron et al., 2006) rather than independent, continuous dimensions (e.g., behavioural control strategies that can be separated into psychological control and behavioural control; Barber, 1966). Limited research has been undertaken to identify different dimensions of parenting behaviours that may be associated with motor and language development. Therefore, this thesis also aimed to examine the impact of six different dimensions of parenting behaviours, namely, responsiveness, warmth, affect, achievement orientation, directiveness, and disciplinary strategies

(that is, punitive discipline, democracy discipline, autonomy discipline and permissive discipline) that have been consistently related to children's developmental outcomes.

Moreover, there is a lack of agreement amongst researchers and clinicians as to which research method (such as parent-reported, child-reported and behavioural observation assessments) is most reliable, accurate and appropriate in measuring parent-child interaction, taking into account practical issues relating to cost-effectiveness and standardisation of measures (Bögels & van Melick, 2004; Lovejoy, Weis, O'Hare, & Rubin, 1999; Rhoades & O'Leary, 2007). Limited comparative studies have focused on the different approaches used to measure parent-child interactions. Although it is possible to use both parent-reported assessments and behavioural observations to measure parent-child interaction, there have been discrepancies between the behaviours measured by both methods, thus limiting the comparability of these measures (Lovejoy et al., 1999). More importantly, it remains unclear if the inconsistencies between the behaviours measured in parent-reported assessments and behavioural observations can be attributed by method effects, situational effects or are due to the inconsistencies in parenting behaviours observed.

Researchers and clinicians studying parenting have also agreed that the most reliable and accurate assessment of parent-child interactions involves the use of multiple measures which could provide complex and rich sources of information (Harvey, Danforth, Ulaszek, & Eberhardt, 2001; Lovejoy et al., 1999; O'Connor, 2002; Tyano, Keren, Herrman, & Cox, 2010). Moreover, using multiple methods provides the opportunity to review the degree of convergence on different dimensions of parenting behaviours. Henceforth, this thesis also aims to provide preliminary evidence by systematically comparing and contrasting different parenting measurements (parent-reported questionnaires, namely, PBDQ, and naturalistic observation, namely, MBRs-R), and use them to identify the particular qualities of parent-child interactions that show an impact on children's motor and language development.

In summary, this thesis was undertaken with three major aims. First, it aimed to determine the possible causal relationships between parent-child interactions, and motor and language development in typically developing children aged four to six

years. Second, this thesis aimed to differentiate various dimensions of parenting behaviours including responsiveness, warmth, affect, achievement orientation, directiveness, and disciplinary strategies (namely, punitive discipline, democracy discipline, autonomy discipline and permissive discipline) that have been consistently associated with children's motor and language development. Last, this thesis also aimed to extend our knowledge by systematically comparing and contrasting different parenting measurements (parent-reported questionnaires, namely, PBDQ, and naturalistic observation, namely, MBRS-R), and to define and measure what are the most important qualities of parent-child interactions and their impact on children's motor and language development.

#### **4.1 Research Significance**

The findings from this thesis aim to advance our knowledge of the relationships between mother-child interactions, and motor and language development, particularly in children from four years old to middle childhood who may experience difficulties in these areas. Recently, some researchers have also suggested that there is co-morbidity between children with DCD and SLI, which was found to be 32.30%, about six times higher than the general population (Flapper & Schoemaker, 2012). Therefore, this thesis could provide a better understanding of the underlying factors in mother-child interactions and the possible effects on the child's developmental attainment. More importantly, this thesis could also extend our understanding of the development of early intervention that incorporates adaptive mother to child interactive behaviour strategies to support children who may experience difficulties in motor and language areas.

By using a mixed method approach (mother-reported questionnaires versus naturalistic observation), this thesis could provide a more reliable and accurate assessment of different dimensions of parenting behaviours so that essential information can be drawn from these measures. This could extend our knowledge of whether different measures describe the same dimensions of parenting behaviours. In summary, this thesis not only extends our understanding of the extent to which a mother's support, guidance and teaching of a child's actions and behaviours play a significant role in a child's motor and language development, but more importantly how it influences the child's overall level of adaptive functioning in return.

## **4.2 Overall Research Plan**

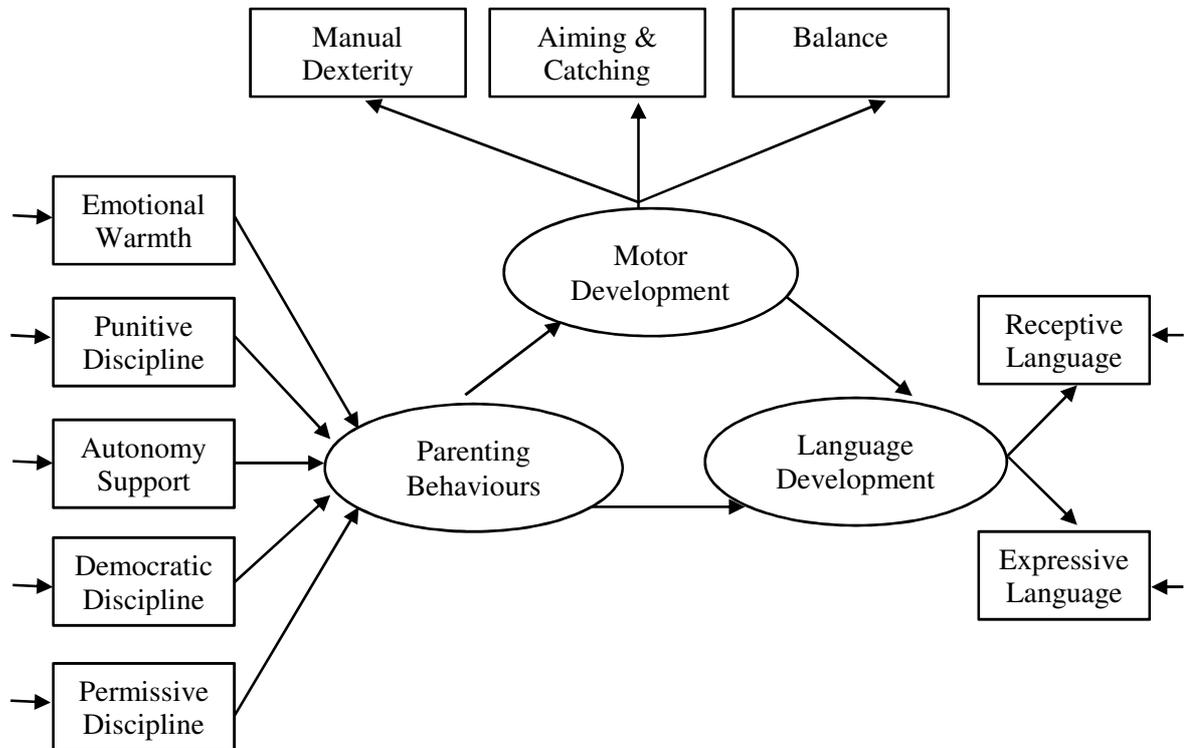
This thesis consists of three studies using two different measures of parenting (mother-reported questionnaires versus naturalistic observation) to investigate the relationships between parenting behaviours, and motor and language development.

### **4.2.1 Study 1.**

Study 1 examined the possible causal relationships between mother-child interaction, and motor and language development. Mother-child interactions were measured using a mother-reported questionnaire (namely, PBDQ; Reid et al., 2012). A normative sample of typically developing children aged four to six years participated in this study. Potential confounding variables included the child's sex, age, verbal and non-verbal IQ, as well as the mother's age, the level of education, family income and ethnicity. It was hypothesised that the mother-child interaction would be a predictor of motor and language development. It was also hypothesised that parenting behaviours (Emotional Warmth, Punitive Discipline, Autonomy Discipline, Democratic Discipline and Permissive Discipline), would have a positive direct effect on language development (Receptive and Expressive Language); parenting behaviours would have a positive effect on motor development (Manual Dexterity, Aiming and Catching, and Balance) through a direct path; motor development would have a positive direct effect on language development as presented in Figure 4.1.

Study 1 extends previous research in so far as it examines the association between mother-child interactions and developmental outcomes, particularly motor and language development. This assumption is supported by past research that reveals there are relationships between parenting behaviours, and motor (Cress et al., 2008; Lomax-Bream et al., 2007; Treyvaud et al., 2009) and language (Barnett et al., 2012; Fewell & Deutscher, 2004; Hirsh-Pasek & Burchinal, 2006; Magill-Evans & Harrison, 1999, 2001; McDonald & Pien, 1982) development. Also previous studies have suggested that there is a possible linkage between motor and language development in young children (Campos et al., 2000; Gernsbacher et al., 2008; Iverson, 2010; Meier et al., 2008; Viholainen et al., 2006; Vukovic et al., 2010). Thus Study 1 will provide preliminary evidence in relation to whether motor development mediates the relationship between mother-child interaction (as

predictor) and language development (the outcome). Study 1 also extends our knowledge with regard to the strengths and limitations of using parent-reported questionnaires to measure parent-child interaction.

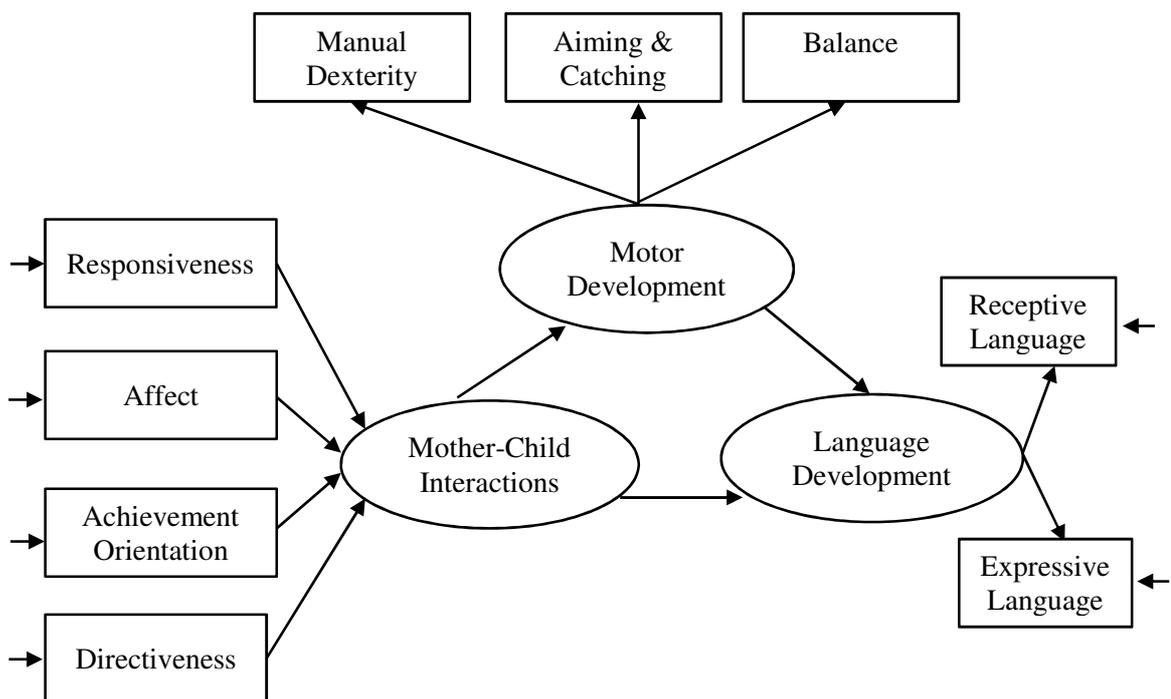


*Figure 4.1.* Proposed mediation model to examine the possible causal relationships between parenting behaviours (parent-reported assessments), motor development and language development.

#### 4.2.2 Study 2.

Study 2 examined the possible causal relationships between mother-child interactions, and motor and language development, in which parenting behaviours were observed in a naturalistic setting. Participants for this study were derived from the same pool of mother-child dyads as in Study 1, who also agreed to be videotaped during a free play session in their home lasting about 20 minutes. Interrater reliability was established amongst the author and three independent raters, in which the observed mother-child interactions were systematically rated using MBRS-R (Mahoney, 2008). Potential confounding variables including child's sex, age and verbal and non-verbal IQ, as well as the mother's age, her level of education, the

family income and ethnicity were controlled. It was hypothesised that the mother-child interaction would be a significant predictor of motor and language development. It was also hypothesised that mother-child interactions (namely, MBRS-R, as measured by Responsiveness, Affect, Achievement Oriented and Directiveness), would have a positive direct effect on language development (as measured by Receptive and Expressive Language); mother-child interactions would have a positive effect on motor development (as measured by Manual Dexterity, Aiming and Catching, and Balance) through a direct path; motor development would have a positive direct effect on language development as presented in Figure 4.2. Study 2 extends previous research in so far as it examines the relationship between mother-child interactions, and motor and language development. More importantly, Study 2 will provide preliminary evidence that motor development has a mediation effect on the relationship between the mother-child interaction (as predictor) and language development (the outcome).



*Figure 4.2.* Proposed mediation model to examine the possible causal relationships between parenting behaviours (observation), motor development and language development.

### 4.2.3 Study 3.

Study 3 was an exploratory study to examine the preliminary evidence from a comparison of two different measures: (a) parent-reported questionnaires (PBDQ); and (b) naturalistic observation (MBRS-R). Study 3 examined whether the dimensions of parenting in PBDQ (as measured by Emotional Warmth, Punitive Discipline, Autonomy Discipline, Democratic Discipline and Permissive Discipline) were correlated with the dimensions of parenting in MBRS-R (as measured by Responsiveness, Affect, Achievement Oriented and Directiveness). It was hypothesised that a set of variables (PBDQ) were correlated with another set of variables (MBRS-R) as presented in Figure 4.3. Therefore, it was predicted that different parenting dimensions were clustered or correlated regardless of the methodologies used. This study provides evidence for the importance of assessing and simultaneously analysing multiple parenting behavioural dimensions in two different measures.

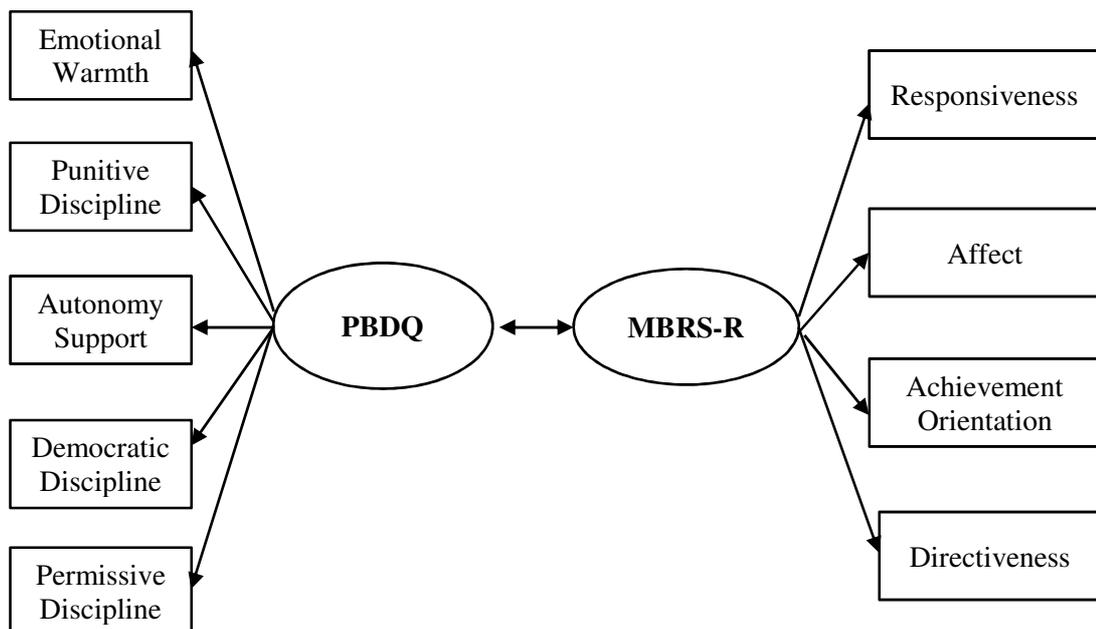


Figure 4.3. Proposed canonical correlation analyses between the PBDQ and the MBRS-R variables.

# Chapter 5

## Study 1

### 5.1 Overview

Different qualities of parenting behaviours have been identified as contributing factors in children's motor development (Cress et al., 2008; Lomax-Bream et al., 2007; Treyvaud et al., 2009), and language development (Hirsh-Pasek & Burchinal, 2006; Magill-Evans & Harrison, 1999, 2001). In addition, some researchers have pointed to the importance of motoric behaviour, and how it could provide the opportunity to learn essential skills relevant to later language attainment (Campos et al., 2000; Iverson, 2010; Viholainen et al., 2006; Wang et al., 2014). This assumption is consistent with the existing evidence suggesting that there is a significant relationship between motor and language development in young children (Campos et al., 2000; Iverson, 2010). However, it is not well understood how the linkages between parenting behaviours, and motor and language development directly or indirectly support one another. In addition, limited research has been conducted to examine the relationship between parenting behaviours and children's developmental outcomes beyond the first few years. This notion is supported by previous research that suggests parent-child interaction is bi-directional; therefore the impact of different parenting behaviours is likely to change depending on the child's developmental stage (Steinberg, Elmen & Mounts, 1989).

Parent-reported assessments have been used by researchers and clinicians to provide support for the relationship between parenting behaviours and psychosocial functioning in children, due to their practicality and cost-effectiveness. However, issues with psychometric properties in the absence of confirmatory factor analytic data to support the theoretically derived parenting behaviours have limited the usage of these assessments (Reid, 2012). Moreover, most of the existing assessments have been used to determine specific functioning rather than a diverse range of developmental outcomes. For example, the APQ (Frick, 1991) that measures parental involvement, positive parenting, poor monitoring/supervision, inconsistent discipline, and corporal punishment has been commonly used in examining the role of parenting in the development and maintenance of anti-social behaviours and conduct problems including aggression, non-compliance, and rule violations in

young children (Dadds et al., 2003). Thus it appears that the most common and well-researched parenting measures have been developed to ascertain the role of parenting for specific developmental outcomes.

Other dimensions of parenting behaviour such as psychologically controlling behaviour that could have a unique influence on the relationship between parenting behaviours and developmental outcomes in children, have not been included in the existing assessments (Reid, 2012). To overcome the limitations associated with existing parenting assessments, Reid developed an assessment that included parenting dimensions of democracy, autonomy support and psychological control that have not been included in other parenting assessments. Reid et al. (2012) systematically reviewed and compared dimensions of parenting behaviours with other theoretically related constructs to form broad parenting factors, and redefined these into core parenting features that could be associated with a broader range of developmental outcomes. The PBDQ was based on questions from existing assessments including PSDQ (Robinson et al., 1995), PAQ-R (Reitman et al., 2002), APQ (Shelton et al., 1996), Parent-Child Relationship Questionnaire (Furman & Adler, 1983, as cited in Furman & Giberson, 1995), and the Weinberger Parenting Inventory-Parent Version (Weinberger et al., 1989, as cited in Wentzel, Feldman, & Weinberger, 1991). In addition, stringent empirical procedures based on an approach incorporating multiple dimensions of parenting behaviours have been employed to ensure that the psychometric properties of PBDQ are sound.

Given the evidence that parenting behaviours could play a significant role in children's motor and language development, it is not well understood how the linkages between parenting behaviours, and motor and language development directly or indirectly support one another. Therefore, Study 1 examined several mediation models using a normative sample of typically developing children aged four to six years, whilst controlling for the child's age, mother's age, family income, mother's education, and ethnic group. This is because existing literature has demonstrated that these factors were associated with parenting behaviours (Fulgini & Brooks-Gunn, 2013; Karrass et al., 2002; Lovejoy et al., 2000; Tamis-LeMonda, Bornstein, & Baumwell, 2001). The PBDQ was used to measure parent-child interactions. Study 1 hypothesised that:

- (1) Different dimensions of parenting behaviours (as measured by emotional warmth, punitive discipline, autonomy support, permissive discipline and democratic discipline) will predict a child's language development.
- (2) Different dimensions of parenting behaviours (as measured by emotional warmth, punitive discipline, autonomy support, permissive discipline and democratic discipline) will predict a child's motor development.
- (3) Maternal characteristics such as age and levels of education, ethnicity and family income will predict the different dimensions of parenting behaviours towards their child.
- (4) A child's characteristics such as sex, age, verbal and non-verbal IQ will predict parenting behaviours.
- (5) Motor skills will mediate the relationship between different dimensions of parenting behaviours (as indicated by measures of emotional warmth, punitive discipline, autonomy support, permissive discipline and democratic discipline) and language attainment by the child at preschool and early school (as indicated by measures of receptive and expressive language measures).

It is important to note that correlational data cannot be used to establish cause-and-effect relationship; the present correlational analysis can only determine the degree to which the proposed causal model has the capacity to generate the correlational data.

## **5.2 Method**

### **5.2.1 Participants.**

Participants consisted of 204 mothers aged from 24 to 48 years ( $M = 36.76$ ,  $SD = 5.11$ ), and their children aged four to six years eleven months ( $M = 4.97$ ,  $SD = 0.85$ ), who were attending kindergarten, pre-primary or Year 1 in the metropolitan area of Perth, Western Australia. Of the 204 participants, 34 mother-child dyads were recruited through the Animal Fun program (Piek et al., 2010). This program was developed as a project that promotes young children's motor and social development at school. There were six exclusion criteria: (a) the child scored less than 70 on the non-verbal component of the Wechsler Preschool and Primary Scale of Intelligence, Third Edition (WPPSI-III) Australian (Wechsler, 2004); (b) the child's age exceeded the specific age-band stated by the standardised measure at time of testing; (c)

voluntary withdrawal; (d) missing responses on the questionnaire(s); (e) the child did not complete the standardised measure(s); and (f) the child was diagnosed with a neurological problem, language disorder or motor disorder because the present study focused only on typically developing children.

Of the 204 cases recruited, 21 children were excluded based on the exclusion criteria. These included two children scored below 70 on the non-verbal component of the WPSSI-III (Wechsler, 2004), six children exceeded the specific age-band stated by the standardised measure at time of testing, one voluntary withdrawal by the father, three missing responses on the questionnaire(s), five children who did not complete the standardised measure(s), one child diagnosed with a known neurological problem, and three children diagnosed with a language disorder. The final sample comprised 183 children, including 100 boys (55%) and 83 girls (45%); 73 (40%) children were in kindergarten, 54 (29%) children in pre-primary, and 56 (31%) children in Year 1.

The majority of mothers who completed the questionnaires were married (91%), and indicated that their ethnic identity was Australian (81%). In addition, 65% of participants indicated that the household family income exceeded AUD\$80,000 yearly, and 62% reported having completed a university degree or higher. According to the Household Income and Income Distribution 2011-12 Report that is available from the Australian Bureau of Statistics (ABS, 2013) website, household family income of Australian families can be categorised into three different income levels: (a) low income; (b) middle income; and (c) high income. Low income indicates a household family income of equal to or below AUD\$24,700 yearly, middle income indicates a household family income of equal or above AUD\$41,236 yearly, and high income indicates a household family income exceeding AUD\$94,328 yearly. The demographic information of mothers and families' is presented in Table 5.1.

Table 5.1

*Demographic Information of Mothers and Families for Study 1 (N = 183)*

	<i>n</i>	%
<b>Mother's Marital Status</b>		
Single	4	2.20
Married/Defacto	166	90.70
Separated	3	1.60
Divorced	10	5.50
<b>Mother's Highest Level of Education</b>		
High School Years 8 to 10	13	7.10
High School Years 11 to 12	31	16.90
Apprentice/Technical	8	4.40
Diploma	18	9.80
University Degree	96	52.50
University Postgraduate	17	9.30
<b>Mother's Ethnic Identity</b>		
Australian	149	81.40
Indigenous Australian or Torres Strait Island	4	2.20
Northern or Western European	7	3.80
Southern European	1	0.50
Eastern European	1	0.50
African	1	0.50
Middle-Eastern	1	0.50
Asian	15	8.20
White South African	4	2.20
<b>Household yearly income</b>		
AUD\$80,000 and above	118	64.50
AUD\$50,000 to AUD\$79,000	15	8.20
AUD\$30,000 to AUD\$49,000	24	13.10
AUD\$30,000 and below	20	10.90
Not stated	6	3.30
<b>Number of children (in family)</b>		
1 child	9	4.90
2 children	89	48.60
3 children	32	17.50
More than 3 children	4	2.20
Not stated	49	26.80

## **5.2.2 Measures.**

### **5.2.2.1 Parenting behaviours and dimensions questionnaire.**

The PBDQ (Reid et al., 2012; see Appendix F) consists of 28 items measuring five different dimensions of parenting behaviours including emotional warmth (six items), punitive discipline (six items), responsiveness (five items), discipline consistency (six items) and democratic discipline (five items). Each item is rated on a six-point Likert scale (1 = *never* to 6 = *always*). The items are randomly ordered and written in terms of both negative and positive statements regarding parenting behaviours when interacting with their children. The punitive discipline and permissive discipline items are reverse scored. Scores are obtained by averaging the total item scores in each subscale. A total PBDQ score can be obtained by summing the mean score for each subscale. High scores indicate positive parenting behaviours when interacting with their children. A Cronbach's alpha value greater than .70 indicates the scale has acceptable internal consistency reliability (Pallant, 2005).

In the study conducted by Reid (2012), the PBDQ has shown a strong test-retest reliability ranging from  $r = .77$  to  $r = .93$  over two weeks, and ranging from  $r = .74$  to  $r = .90$  over four weeks. The internal consistency reliability for PBDQ ranged from acceptable to excellent with Cronbach's alpha of .78 for Emotional Warmth, .79 for Punitive Discipline, .70 for Autonomy Support, .73 for Permissive Discipline, and .84 for Democratic Discipline. The PBDQ was also significantly correlated with measures of child emotion, behavioural and social outcomes.

In the present study, the PBDQ's cronbach's alpha ranged from .63 to .75 across the five subscales. In particular, the internal consistency reliability was Cronbach's alpha of .75 for emotional warmth; .70 for Punitive Discipline; .68 for Autonomy Support; .63 for Permissive Discipline; and .71 for democratic discipline.

### **5.2.2.2 Motor skills.**

The Movement Assessment Battery for Children – Second Edition (MABC-2; Henderson, Sugden, & Barnett, 2007) is designed to assess and identify impairment in motor performance in children for three age bands: (a) three to six years, (b) seven to 10 years, and (c) 11 to 16 years. Only Age Band 1 was used in the current study. It contains eight tasks or subtests (namely, posting coins, threading, drawing trail,

catching beanbag, throwing beanbag onto mat, one-leg balance, walking heels raised along a straight line, and jumping on mats) for each age range and is divided into three different motor areas: (a) Manual Dexterity; (b) Aiming and Catching (ball skills); and (c) Static and Dynamic Balance. The MABC-2 was standardised on 1172 U.K. children aged between 3 years and 16 years 11 months. The sample was normal with regard to age, gender, race/ethnicity, level of parent education, and geographical region. Cronbach's alpha amongst the subscales ranged from .73 to .84 and are equal to .80 for the Total Score (Henderson et al., 2007). In the present study, MABC-2 yielded a Cronbach's alpha of .64 for Manual Dexterity, .45 for Aiming and Catching, and .47 for Balance.

While some studies have shown good to excellent internal consistency for the MABC-2, the alphas for the MABC in Study 1 are only moderate to low (Ellinoudis, Kourtessis, & Kiparissis, 2008; Hua, Gu, Meng, & Wu, 2013). As suggested by some researchers, the low alphas in Study 1 might have been attributed to the relatively small number of items in the MABC-2 (Ellinoudis, 2008; Ellinoudis, Evaggelinou, Kourtessis, Konstantinidou, Venetsanou, & Kambas, 2011; Nunnally & Bernstein, 1994). In this instance, the Aiming and Catching subscale consist of only two items (e.g., catching beanbag and throwing beanbag onto the mat). The less the number of items is, the smaller the alpha values.

### ***5.2.2.3 Receptive and expressive language skills.***

The Clinical Evaluation of Language Fundamentals – Preschool Second Edition (CELF PRE-2; Wiig, Secord, & Semel, 2006) is a standardised test which consists of receptive subtests and expressive subtests, as well as composite scores for total language, receptive language, and expressive language. The CELF-P is standardised on 800 preschoolers, representative of the U.S. population with regard to gender, race/ethnicity, parent education, and geographical region. Internal consistency estimates for composite scores (as measured by Cronbach's alpha) ranged from .73 to .96 across age groups, with test-retest coefficients ranging from .87 to .97. In this study, Cronbach's alpha was .76 for receptive language subscale and .74 for expressive language subscale.

### ***5.2.2.4 Cognitive skills.***

The WPPSI-III (Wechsler, 2004) consists of 14 subtests. It is used to assess children's cognitive functioning. This standardised measure provides an estimate of the child's overall intelligence quotient (IQ) and individual functioning across four areas: verbal abilities, non-verbal (perceptual reasoning) abilities, processing speed quotient and general language quotient. The WPPSI-III scores are interpreted in relation to an age-related standardised population sample. In the present study, only two subtests were used to assess verbal (e.g., Vocabulary and Comprehension subtests) and non-verbal (e.g., Block Design and Object Assembly subtests) skills with a Cronbach's alpha of .83 for verbal and .66 for non-verbal skills.

#### ***5.2.2.5 Parent questionnaire.***

This form was completed by mothers and included demographics such as mother's age, level of education, marital status, ethnicity, family income and number of children, as well as the child's demographics such as age, gender and any known history of neurological, medical, visual and hearing, motor, learning and psychological problems.

#### **5.2.3 Procedure.**

Approval for this study was obtained from the Human Research Ethics Committee of Curtin University (approval number HR01/2011; see Appendix A), the Department of Education, Western Australia (approval number D11/0282263; see Appendix B), and the Catholic Education Office, Western Australian (see Appendix C).

Subsequently, a detailed information letter (see Appendix D) and informed consent form (see Appendix E) together with a copy of the PBDQ (Reid et al., 2012; see Appendix F) and Parent Questionnaire (see Appendix G) were attached to a letter of invitation, and sent to 204 schools chosen randomly in the Perth metropolitan area. A total of nine schools from public and catholic schools agreed to participate in the study.

Together with the School Principal or Assistant School Principal's written consent, an information letter for mother and child (see Appendices H and I), informed consent forms for mother and child (see Appendices J and K), PBDQ and Parent Questionnaire, were given to each child in an enclosed envelope. The

envelope containing these documents was then passed on from the child to their parents. The information letter described the study objectives, what was required from the school, mother and child respectively, advice regarding the freedom from coercion to participate or to withdraw at any time, and the contact details of the researcher and supervisors involved in this study. Once the parents signed the consent form and completed the PBDQ and Parent Questionnaire, these documents were returned by the child's mother to either the school's office or the child's class teacher in a sealed envelope.

At the school, three standardised measures (language, motor and cognition) were administered to the child in a quiet room which took approximately 90 minutes. These measures were administered individually by a Registered Psychologist (author), as well as four trained fourth year Psychology students. Training and supervision were provided by the Registered Psychologist to each student to ensure that the testing was carried out in accordance with a standardised procedure. In addition the author and students were trained by one a qualified speech-language therapist in the correct administration of the standardised measure for language.

Due to fatigue and the short attention span of young children, all three measures were administered individually across two to three different periods of time. Short breaks in between each administration were also provided for the child when needed. When a child had been previously assessed in the areas of cognitive, language, or motor functioning in the past 12 months using the same measures, written permission was obtained from his or her parents to obtain a copy of these assessments from the school or relevant health professional.

#### **5.2.4. Statistical analyses.**

Data were analysed using the Statistical Package for the Social Sciences (SPSS Version 19). The analysis consisted of six steps. Step 1 was concerned with computing descriptive statistics including means, standard deviations and ranges for each of the study variables. Step 2 involved testing the assumptions underlying Pearson's correlations such as normality and linearity. In Step 3, bivariate correlations were computed between study variables (Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline Democratic Discipline, Manual Dexterity, Aiming and Catching, Balance, Receptive Language, and

Expressive Language) and potential control variables (child's sex, child's age, mother's age, family income, mother's educational level, ethnicity, verbal IQ, and non-verbal IQ). In Step 4, the bivariate correlations among the study variables - and their corresponding partial correlations (partialling out the influence of the significant control variables identified in Step 3) - were computed. Step 5 involved testing the assumptions underlying structural equation modelling such as the absence of multicollinearity and multivariate normality. In Step 6, structural equation modelling using LISREL (Version 8.54; Jöreskog, & Sörbom, 2004) was conducted on the Step 4 partial correlations to determine whether motor development mediates the relationship between parenting behaviours and language development.

### **5.3 Results**

#### **5.3.1 Descriptive statistics.**

The means, standard deviations, and ranges for the parenting behaviours, motor, language and cognitive assessments are presented in Table 5.2. The parenting behaviour (PBDQ) scores were obtained by summing the scores for all items in each subscale. Both emotional warmth ( $M = 5.53$ ;  $SD = 0.38$ ; range 4.17 to 6.00) and democratic discipline ( $M = 5.31$ ;  $SD = 0.50$ ; range 3.60 to 6.00) subscales had narrow ranges. Similarly, punitive discipline ( $M = 4.83$ ;  $SD = 0.55$ ; range 3.00 to 6.00) and autonomy support ( $M = 5.04$ ;  $SD = 0.51$ ; range of 3.00 to 6.00) subscales had narrow ranges.

A total test score for motor skills was obtained by summing the eight MABC-2 subtest standard scores. In the MABC-2, total test scores ( $M = 79.74$ ;  $SD = 11.66$ ; range 49 to 109) were used to describe three different levels of motor difficulty commonly known as 'traffic light' systems. In this instance, the red zone with a total test score of up to and including 56 describes a significant movement difficulty, whereas the amber zone with a total test score between 57 and 67 indicates that the child is at risk of having a movement difficulty. Last, the green zone with a total test score of above 67 indicates that no movement difficulty is present. In this study, six children (3%) scored from 49 to 56 (regarded as having significant movement difficulty), and 22 (12%) children scored between 57 and 67 (regarded as at risk of having movement difficulty), although none had been previously diagnosed with a

motor disorder. The remaining 155 (85%) children scored from 68 to 109, indicating no motor difficulty was present.

For the measure of language (CELF PRE-2), core language scores ( $M = 101.39$ ;  $SD = 12.35$ ; range 55 to 136) were used to describe the different levels of language impairment. The total core language score was obtained by summing the three subtest (as measured by Sentence Structure, Word Structure and Expressive Vocabulary) standard scores, in which low core language scores suggested that the child had significant language difficulties, and high scores indicated that child's language proficiency was the same or better than similarly aged children. The core language scores were categorised into five different levels of child's language performance when compared to similar age peers: (a) a score of 70 and below indicates a Very Low range; (b) scores of 71 to 77 indicate Moderate range; (c) scores of 78 to 85 indicate Borderline range; (d) scores of 86 to 114 indicate Average range; and (e) a score of 115 and above indicates Above average. In this study, three (2%) children scored between 55 to 70 indicating a Very Low range (regarded as having severe language difficulties), another five (3%) children scored between 75 to 77 indicating a Moderate range (regarded as having language difficulties), and five (3%) other children scored between 80 to 82 indicating a Borderline range (regarded as at risk of having language difficulties). None of these children had previously been diagnosed with a language disorder. Another 148 (80%) children scored between 86 and 114 indicating language performance was at an Average range when compared to similarly aged children, whereas the remaining 22 (12%) children scored between 116 and 136 indicating that their language performance was Above Average in comparison to their same-aged peers.

The WPPSI-III was used to measure children's cognitive skills. In the present study, only verbal skill (also known as the verbal index quotient; VIQ) as measured by Vocabulary and Comprehension subtests and, non-verbal skill (also known as the performance index quotient; PIQ) as measured by Block Design and Object Assembly subtests, were assessed. Low composite scores suggested low performance of cognitive skills. In this instance, composite scores of: (a) less than 69 indicate an Extremely Low range; (b) scores between 70 to 79 indicate a Borderline range; (c) scores between 80 to 89 indicate a Low Average range; (d) scores between 90 to 109

indicate an Average range; (e) scores between 110 to 119 indicate a High Average range; (f) scores between 120 to 129 indicate a Superior range; and (g) scores more than 130 indicate a Very Superior range.

In this study, composite scores of VIQ showed that seven (4%) children scored between 72 and 78 indicating a Borderline range, 23 (13%) children scored between 81 and 88 indicating a Low Average range, 101 (55%) children scored between 91 to 109 indicating an Average range, and 52 (28%) children scored from 111 to 141 indicating a High Average to Very Superior range. Furthermore, the PIQ composite scores revealed that 17 (9%) children scored between 73 and 79 indicating a Borderline range, 39 (21%) children scored between 81 to 86 indicating a Low Average range, 77 (43%) children scored between 90 to 107 indicating an Average range, and 50 (27%) children scored from 112 to above 132 indicating a High Average to Very Superior range.

Table 5.2

*Means, Standard Deviations, and Ranges for the Study Variables (N = 183)*

Scale	Mean	SD	Range
PBDQ emotional warmth <sup>a</sup>	5.53	0.38	4.17 – 6
PBDQ punitive discipline <sup>a^</sup>	4.83	0.55	3 – 6
PBDQ autonomy support <sup>a</sup>	5.04	0.51	3 – 6
PBDQ permissive discipline <sup>a^</sup>	4.32	0.60	2.50 – 5.67
PBDQ democratic discipline <sup>a</sup>	5.31	0.50	3.60 – 6
MABC-2 manual dexterity <sup>b</sup>	9.65	2.77	2 – 19
MABC-2 aiming and catching <sup>b</sup>	10.34	3.01	1 – 19
MABC-2 balance <sup>b</sup>	11.03	3.22	5 – 18
CELF PRE-2 receptive language <sup>c</sup>	101.07	11.70	66 – 128
CELF PRE-2 expressive language <sup>c</sup>	100.91	12.75	61 – 140
WPPSI-III PIQ <sup>d</sup>	98.89	15.23	73 – 144
WPPSI-III VIQ <sup>d</sup>	104.22	13.63	72 – 141

*Notes:* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2; WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-III; PIQ = Performance Intelligence Quotient; VIQ = Verbal Intelligence Quotient.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b</sup> Scaled score.

<sup>c,d</sup> Age-standardised score.

<sup>^</sup> Reverse scored.

### 5.3.2 Assumption testing for Pearson's *r*.

The Pearson correlation assumes that the variables being correlated are normally distributed, linearly related, and homoscedastic. Each of these assumptions is tested in turn.

### ***5.3.2.1 Normality.***

As suggested by Field (2005), statistics of skewness and kurtosis were converted to z-scores by dividing the skewness and kurtosis values by their respective standard errors (see Table 5.3). Field (2005) recommended a cut-off z-score value of 2.58 for a sample size less than 200. Results indicated that Emotional Warmth, Autonomy Support, Permissive Discipline and Democratic Discipline exceeded an absolute value of 2.58 for skewness, kurtosis or both.

The Pearson correlations (which assume normality) were compared to the Spearman correlations (which do not assume normality) to determine the impact of the normality violations reported previously. The pattern of significant correlations was comparable across the two correlation matrices (see Appendix M). It was therefore concluded that the departures from normality shown by some of the measures had little impact on the reliability of the Pearson correlation. The more versatile Pearson correlation was therefore used for the remainder of the analyses including the structural equation modelling.

Table 5.3

*Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 183)*

	Skewness		Kurtosis	
	Raw Score	z-score	Raw Score	z-score
PBDQ emotional warmth <sup>a</sup>	-1.08	-5.98 <sup>d</sup>	1.21	3.38 <sup>d</sup>
PBDQ punitive discipline <sup>a ^</sup>	-0.26	-1.44	0.35	0.10
PBDQ autonomy support <sup>a</sup>	-1.19	-6.62 <sup>d</sup>	2.66	7.46 <sup>d</sup>
PBDQ permissive discipline <sup>a ^</sup>	-0.54	-3.01 <sup>d</sup>	0.36	1.01
PBDQ democratic discipline <sup>a</sup>	-0.63	-3.48 <sup>d</sup>	0.13	0.37
MABC-2 manual dexterity <sup>b</sup>	0.15	0.82	0.49	1.36
MABC-2 aiming & catching <sup>b</sup>	0.05	0.26	0.55	1.54
MABC-2 balance <sup>b</sup>	0.29	1.59	-0.71	-1.98
CELF PRE-2 receptive language <sup>c</sup>	-0.15	-0.82	-0.12	-0.33
CELF PRE-2 receptive language <sup>c</sup>	-0.19	-1.04	0.88	2.46

*Notes:* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b,c</sup> Scaled score.

<sup>d</sup> z-score exceeded an absolute value of 2.58.

<sup>^</sup> Reverse scored.

### 5.3.2.2 *Linearity.*

Scatterplots of the bivariate relationships were examined. The 10 measures generated 144 bivariate scatterplots. A random selection of 20% ( $n = 11$ ) of the 55 scatterplots showed no obvious curvilinear trends (see Appendix M); linearity was therefore assumed.

### **5.3.2.3 Homoscedasticity.**

Homoscedasticity between a pair of measures can be tested by conducting a regression analysis with one measure as the dependent variable and the other as the predictor, and then examining the plot of the standardised studentised residuals against the standardised predicted values. Heteroscedasticity is indicated when the points fan out from left-to-right or from right-to-left. A random selection of 20% of the 55 plots showed no obvious fanning out (see Appendix M), suggesting that the assumption of homoscedasticity had not been violated.

### **5.3.3 Pearson's correlation.**

Bivariate correlations were computed between the indicators (Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline Democratic Discipline, Manual Dexterity, Aiming and Catching, Balance, Receptive Language, and Expressive Language) and potential control variables (child's sex, child's age, mother's age, family income, mother's educational level, ethnicity, verbal IQ, and non-verbal IQ). In order to impact the relationships among the latent variables, the control variable needs to be significantly correlated with at least two of the indicators and these indicators need to come from different latent variables. As can be seen in Table 5.4, there were five control variables that satisfied this criterion: Child's age, mother's age, family income, mother's education, and ethnic group. Pearson correlations among the indicators, and the corresponding partial correlations controlling for child's age, mother's age, family income, mother's education, and ethnic group are reported in Table 5.5.

Table 5.4

*Pearson's Correlations between Indicators and Potential Control Variables (N = 183)*

	PBDQ Emotional Warmth	PBDQ Punitive Discipline	PBDQ Autonomy Support	PBDQ Permissive Discipline	PBDQ Democratic Discipline	MABC-2 Manual Dexterity	MABC-2 Aiming & Catching	MABC-2 Balance	CELF PRE-2 RL	CELF PRE-2 EL
Child's Sex	-.044	.011	-.020	.044	-.026	.068	.002	.122	.065	.066
Child's Age	-.042	-.113	-.070	.030	-.045	-.025	.170 *	-.141	-.200 **	-.291 **
Mother's Age	.053	.060	.172 *	.083	.134	.158 *	-.033	.131	.236 **	.187 *
Mother's Educational Level	.017	.082	.211 **	.114	.123	.100	-.029	.138	.268 **	.356 **
Family Income	.099	.154 *	.211 **	.074	.120	.118	-.057	.136	.207 **	.321 **
Ethnicity <sup>a</sup>	-.132	-.154 *	-.040	-.205 **	.066	.025	.104	-.079	-.118	-.261 **
WPPSI-III PIQ <sup>b</sup>	-.001	.084	.099	.042	.004	.124	-.128	.043	.388 **	.295 **
WPPSI-III VIQ <sup>b</sup>	.075	.105	.107	.043	.010	.100	-.120	.081	.443 **	.442 **

*Note.* WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-III; PIQ = Performance Intelligence Quotient; VIQ = Verbal Intelligence Quotient; PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2; RL = Receptive Language; EL = Expressive Language.

<sup>a</sup> 1 = Australian, 2 = Others.

<sup>b</sup> Age-standardised score.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

Table 5.5

*Pearson's Correlations among Indicators: First Order Correlations above Diagonal, Partial Correlations below Diagonal (N = 183)*

	PBDQ Emotional Warmth	PBDQ Punitive Discipline	PBDQ Autonomy Support	PBDQ Permissive Discipline	PBDQ Democratic Discipline	MABC-2 Manual Dexterity	MABC-2 Aiming & Catching	MABC-2 Balance	CELF PRE-2 RL	CELF PRE-2 EL
PBDQ emotional warmth <sup>a</sup>	<b>1.000</b>	.430 **	.476 **	.027	.559 **	-.124	-.110	-.088	-.118	-.044
PBDQ punitive discipline <sup>a ^</sup>	.408 **	<b>1.000</b>	.309 **	.297 **	.348 **	-.161 *	-.043	-.042	-.095	.062
PBDQ autonomy support <sup>a</sup>	.478 **	.293 **	<b>1.000</b>	.201 **	.528 **	-.048	-.065	.027	-.010	.028
PBDQ permissive discipline <sup>a ^</sup>	.000	.279 **	.177 *	<b>1.000</b>	.188 *	.052	.039	.109	.023	.058
PBDQ democratic discipline <sup>a</sup>	.578 **	.359 **	.515 **	.181 *	<b>1.000</b>	-.013	-.015	.043	.025	.060
MABC-2 manual dexterity <sup>b</sup>	-.137	-.180 *	-.092	.045	-.046	<b>1.000</b>	.249 **	.329 **	.216 **	.167 *
MABC-2 aiming & catching <sup>b</sup>	-.088	-.005	-.057	.052	-.017	.260 **	<b>1.000</b>	.199	.024	-.045
MABC-2 balance <sup>b</sup>	-.115	-.083	-.016	.090	.022	.317 **	.155 **	<b>1.000</b>	.156 *	.218 **
CELF PRE-2 RL <sup>c</sup>	-.159 *	-.159 *	-.092	-.024	-.018	.187 *	.068	.098	<b>1.000</b>	.678 **
CELF PRE-2 EL <sup>c</sup>	-.118	-.038	-.076	-.024	.031	.151 *	.026	.149 *	.644 **	<b>1.000</b>

*Note.* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2; RL = Receptive Language; EL = Expressive Language.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b</sup> Scaled score.

<sup>c</sup> Age-standardised score.

<sup>^</sup> Reverse scored.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

### **5.3.4 Assumption testing for structural equation modelling.**

#### ***5.3.4.1 Multivariate normality and multicollinearity.***

In addition to the assumptions tested above, structural equation modelling also assumes that the 10 observed variables are drawn from a multivariate normal population (Kline, 2005). Multivariate normality was not violated in the present study ( $\chi^2 = 6.55, p = .038$ ), which means that the chi-square statistic that is normally used to test model fit will be inflated (Jöreskog & Sörbom, 1989). In these circumstances, Jöreskog and Sörbom (1989) recommend testing for model fit with a chi-square statistic that corrects for the inflation. Jöreskog (2004) argues that the Satorra-Bentler chi-square provides such a statistic, and therefore, this was used as the fit statistic at all stages of analysis. Structural equation modelling also assumes that the latent variables are not multicollinear. Multicollinearity exists when there are substantial correlations ( $> .9$ ) among the latent variables. In the present study, the largest correlation among the latent variables was .396 indicating that multicollinearity was met.

### **5.3.5 LISREL analysis: Structural equation modelling.**

The partial correlations reported below the diagonal in Table 5.5 provided the data for the structural equation modelling analyses. Indicators of the same latent construct should be moderately correlated. The two language indicators (CELF PRE-2 Receptive Language and CELF PRE-2 Expressive Language) satisfied this requirement with a correlation of .678, as did three of the five parenting indicators (Punitive Discipline, Autonomy Support and Democratic Discipline) with correlations ranging between .293 and .515. The correlation between the other two parenting indicators (Emotional Warmth and Permissive Discipline), however, was .000. Punitive Discipline, Autonomy Support and Democratic Discipline were therefore analysed in the same structural equation model (Figure 5.1), whereas Emotional Warmth and Permissive Discipline were analysed in separate structural equation models (Figures 5.2, and 5.3 respectively). The three models have the same structural component, but different measurement components. Model 1, depicted in Figure 1, was analysed first.

### **5.3.5.1 Fit indices.**

The current study uses a mixture of absolute and relative fit indices to evaluate model fit. Absolute fit indices measure how well a model fits the current data, without a baseline comparison model (Hooper, Coughlan, & Mullen, 2008). The first of the absolute indices, and the traditional method, is to assess the chi-square value, in which a non-significant value reflects a good fit. However, for large samples, such as the one investigated in this study, the chi-square is almost always significant (Kenny, 2013). For this reason, the normalised chi-square value (i.e., the chi-square value divided by its degrees of freedom) is more often reported. A normalised chi-square value less than 3 is considered to represent a good fit. Other absolute fit indices include the Root Mean Square Error Approximation and the Standardised Root Mean Square Residual. Acceptable model fit is indicated by an Root Mean Square Error Approximation value of less than or equal to .06 or a 95% confidence interval that straddles this value (Hooper et al., 2008; Hu & Bentler, 1999), and an Standardised Root Mean Square Residual value of less than or equal to .8 (Hu & Bentler, 1999; Miller, Bierly, & Daly, 2007). Both the Root Mean Square Error Approximation and the Standardised Root Mean Square Residual are sensitive to sample size (Hooper et al., 2008).

Incremental or relative fit indices assess model fit by comparing the chi-square to a baseline model in which there are no correlations among the latent variables (Hooper et al., 2008). Relative fit indices include the Normed Fit Index and the Comparative Fit Index. Unlike the Normed Fit Index, the Comparative Fit Index is not sensitive to sample size. Acceptable model fit is indicated by Normed Fit Index and Comparative Fit Index values greater than or equal to .9 (Bentler, 1990; Bollen, 1989; Nargundkar, 2008). Byrne (1989) recommends that the Comparative Fit Index should be the primary fit index.

### **5.3.5.2 Model 1.**

In order to reliably test the measurement model, it is recommended that a minimum five participants should be recruited for each 'free parameter,' although 20 participants per 'free parameter' are preferred (Kline, 2005). The measurement component of Model 1 (Figure 5.1) has eight error variances, eight factor loadings, 10 inter-factor correlations, and five factor variances. According to Kline's rule-of-

thumb, a minimum sample size for testing this system would be 155. Because the measurement component of Model 1 was the most complex system tested in this study, 155 participants served as the recommended minimum sample size throughout the structural equation modelling analyses. The current sample of 183 met this minimum requirement, and should therefore be considered sufficient to provide stable estimates of the path coefficients.

Fit indices for the measurement component of Model 1 are reported in Table 5.6. Specifically, the  $\chi^2/df$  ratio was 1.07 ( $< 3$ ); the Comparative Fit Index was .992 ( $\geq .90$ ); the Normed Fit Index was .937 ( $\geq .90$ ); the Standardised Root Mean Square Residual was .039 ( $\leq 0.08$ ); and the Root Mean Square Error of Approximation was .020 ( $\leq .05$ ). The measurement component therefore provides a good fit for the data, which is expected since three of the five latent variables are single indicator variables in which the measurement error was fixed at 1 – the reliability of the measure (Kline, 2005).

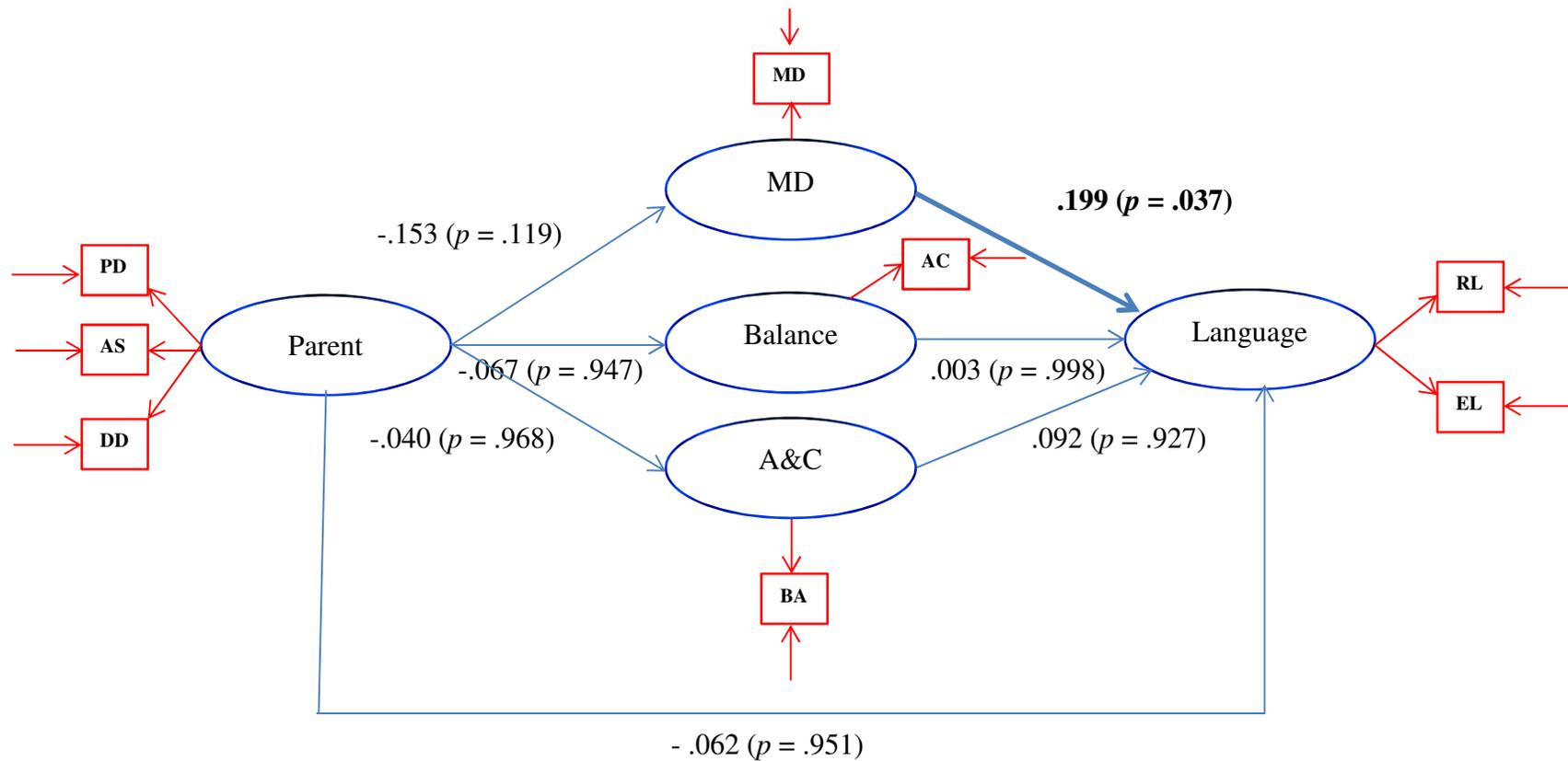


Figure 5.1. Model 1: Measurement model (in red) and structural model (in blue). PD = punitive discipline; AS = autonomy discipline; DD = democratic discipline; MD = manual dexterity; A&C = aiming & catching; BA = balance; RL = receptive language; EL = expressive language.

Table 5.6

*Model 1: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Punitive Discipline, Autonomy Support, Democratic Discipline), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development*

Model	$\chi^2/df$	Comparative Fit Index	Normed Fit Index	Standardised Root Mean Square Residual	Root Mean Square Error of Approximation
Measurement model	13.95/13 = 1.07	.992	.937	.039	.020 (90% CI: .000, .078)
Structural model	49.08/16 = 3.07	.847	.797	.083	.107 (90% CI: .073, .141)

CI = confidence interval.

The structural component of Model 1 did not provide an adequate fit for the data; the  $\chi^2/df$  ratio was 3.07 (> 3); the Comparative Fit Index was .847 (<.90); the Normed Fit Index was .797 (< .90); the Standardised Root Mean Square Residual was .083 (> .08); and the Root Mean Square Error of Approximation was .107 (> .05). The fit indices were reported in Table 5.6. The poor fit of the structural component cannot be explained in terms of a poorly fitting measurement model. The poor fit of the structural component reflects the fact that only one of the seven pathways is significant, namely, the pathway from manual dexterity to language (see Figure 5.1). As can be seen in Table 5.7, this result was to be expected since only one of seven correlations associated with these pathways was significant, namely, the correlation between the latent variables manual dexterity and language ( $r = .238, p = .008$ ).

Table 5.7

*Correlations between Latent Variables in Model 1*

	Parent	MD	A&C	Balance	Language
Parent	1.000				
MD	-0.137	1.000			
A&C	-0.047	0.325 **	1.000		
Balance	-0.013	0.396 **	0.194 *	1.000	
Language	-0.088	0.238 **	0.073	0.158	1.000

Parent = punitive discipline, autonomy support, and democratic discipline; MD = manual dexterity; A&C = aiming and catching; Language = receptive and expressive language.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

Model 1 consisted of one latent factor of parenting behaviours (as measured by Punitive Discipline, Autonomy Support, and Democratic Discipline), three latent factors of motor development (as measured by Manual Dexterity, Aiming and Catching and Balance) and one latent factor of language development (as measured

by Receptive and Expressive Language). The path from parenting behaviours to language development was not significant. Thus the hypothesis that parenting behaviours would have a direct impact on language development in this model was not supported. In addition, the path from parenting behaviours to motor development was also not significant indicating that the prediction that parenting behaviours would have a direct effect on motor development was not supported. However, the path from fine motor skills to language development was significant ( $p = .037$ ), indicating that Manual Dexterity has a direct impact on Receptive and Expressive Language.

### **5.3.5.3 Model 2.**

The fit indices for the measurement component of Model 2 (see Table 5.8) showed that the  $\chi^2/df$  ratio was 0.67 ( $< 3$ ); the Comparative Fit Index was 1.000 ( $\geq .90$ ); the Normed Fit Index was .986 ( $\geq .90$ ); the Standardised Root Mean Square Residual was .013 ( $\leq 0.08$ ); and the Root Mean Square Error of Approximation was .000 ( $\leq .05$ ). The measurement component is therefore an excellent fit for the data, which (once again) is expected since this time four of the five latent variables are single indicator variables in which the measurement error was fixed at 1 – the reliability of the measure (Kline, 2005).

The structural component of Model 2 did not provide an adequate fit for the data; the  $\chi^2/df$  ratio was 5.55 (exceeding the cut-off value of 3); the Comparative Fit Index was .796 ( $< .90$ ); the Normed Fit Index was .776 ( $< .90$ ); the Standardised Root Mean Square Residual was .091 ( $> 0.08$ ); and the Root Mean Square Error of Approximation was .158 ( $> .05$ ). The poor fit of the structural component cannot be explained in terms of a poorly fitting measurement model. The poor fit of the structural component, once again, reflects the fact that most of the pathways in the model are non-significant (see Figure 5.2).

Table 5.8

*Model 2: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Emotional Warmth), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development*

Model	$\chi^2/df$	Comparative Fit Index	Normed Fit Index	Standardised Root Mean Square Residual	Root Mean Square Error of Approximation
Measurement model	2.02/3 = 0.67	1.000	.986	.013	.000 (90% CI: .000, .108)
Structural model	33.28/6 = 5.55	.796	.776	.091	.158 (90% CI: .108, .212)

CI = confidence interval.

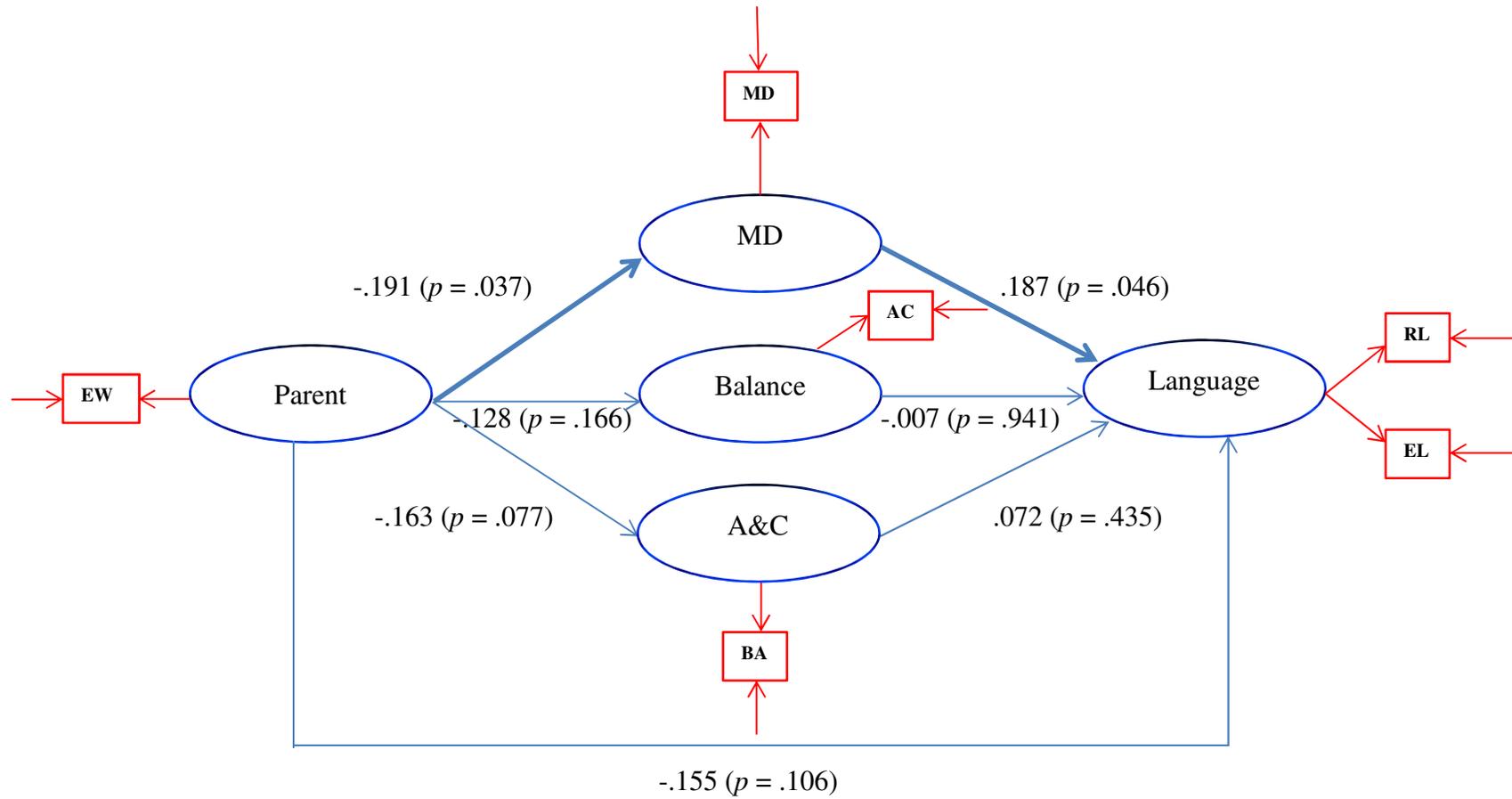


Figure 5.2. Model 2: Measurement model (in red) and structural model (in blue). EW = emotional warmth; MD = manual dexterity; A&C = aiming & catching; BA = balance; RL = receptive language; EL = expressive language.

Model 2 consisted of one latent factor of parenting behaviour (as measured by Emotional Warmth), three latent factors of motor development (as measured by Manual Dexterity, Aiming and Catching and Balance) and one latent factor of language development (as measured by Receptive and Expressive Language). The significance of the pathways from Emotional Warmth to Manual Dexterity, and from Manual Dexterity to Language suggests that fine motor skills might mediate the relationship between parenting behaviours and language outcomes. Before it can be concluded that Manual Dexterity is a mediator, however, two conditions must be satisfied. First we have to show that the *overall* indirect effect from parenting to language via manual dexterity is significant.

The strength of the indirect effect is given by the product of its two component path coefficients (see Figure 5.2);  $-.191$  multiplied by  $.187$  equals  $-.036$ , which is not significantly different to zero ( $z = 1.44, p = .150$ ). Although the component pathways from parenting behaviours to Manual Dexterity, and from Manual Dexterity to language outcomes are both significant, these effects are not strong enough to carry the effect of parenting behaviours through Manual Dexterity to language outcomes. The correlations among the latent variables are presented in Table 5.9.

Table 5.9

*Correlations between Latent Variables in Model 2*

	Parent	MD	A&C	Balance	Language
Parent	1.000				
MD	-0.171	1.000			
A&C	-0.110	0.325 **	1.000		
Balance	-0.114	0.396 **	0.194 *	1.000	
Language	-0.197 *	0.237 **	0.073	0.155	1.000

Parent = emotional warmth; MD = manual dexterity; A&C = aiming and catching; Language = receptive and expressive language.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

#### **5.3.5.4 Model 3.**

The fit indices for the measurement component of Model 3 (see Table 5.10) showed that the  $\chi^2/df$  ratio was 0.61 ( $> 3$ ); the Comparative Fit Index was 1.000 ( $\geq .90$ ); the Normed Fit Index was .986 ( $\geq .90$ ); the Standardised Root Mean Square Residual was .011 ( $\leq 0.05$ ); and the Root Mean Square Error of Approximation was .000 ( $\leq .05$ ). The measurement component is therefore an excellent fit for the data, which is expected since once again four of the five latent variables are single indicator variables.

However, fit indices for the structural model showed that the  $\chi^2/df$  ratio was 5.92 ( $> 3$ ); the Comparative Fit Index was .756 ( $< .90$ ); the Normed Fit Index was .738 ( $< .90$ ); the Standardised Root Mean Square Residual was .097 ( $> .08$ ); and the Root Mean Square Error of Approximation was .164 ( $> .05$ ). The fit indices indicated a poor fit for the structural model (see Table 5.10).

Table 5.10

*Model 3: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Permissive Discipline), Motor (Manual Dexterity, Aiming and Catching, and Balance), and Language (Receptive and Expressive Language) Development*

Model	$\chi^2/df$	Comparative Fit Index	Normed Fit Index	Standardised Root Mean Square Residual	Root Mean Square Error of Approximation
Measurement model	1.82/3 = 0.61	1.000	.986	.011	.000 (90% CI: .000, .103)
Structural model	35.49/6 = 5.92	.756	.738	.097	.164 (90% CI: .115, .218)

CI = confidence interval.

Model 3 (see Figure 5.3) consisted of one latent factor of parenting behaviour (as measured by Permissive Discipline), three latent factors of motor development (as measured by Manual Dexterity, Aiming & Catching, and Balance) and one latent factor of language development (as measured by Receptive and Expressive Language). The poor fit of the structural component cannot be explained in terms of a poorly fitting measurement model. The poor fit of the structural component reflects the fact that only one of the seven pathways is significant, namely, the pathway from Manual Dexterity to language outcomes. This result was to be expected since only one of seven correlations associated with these pathways was significant, namely, the correlation between the latent variables Manual Dexterity and language outcome ( $r = .237, p = .008$ ) as presented in Table 5.11.

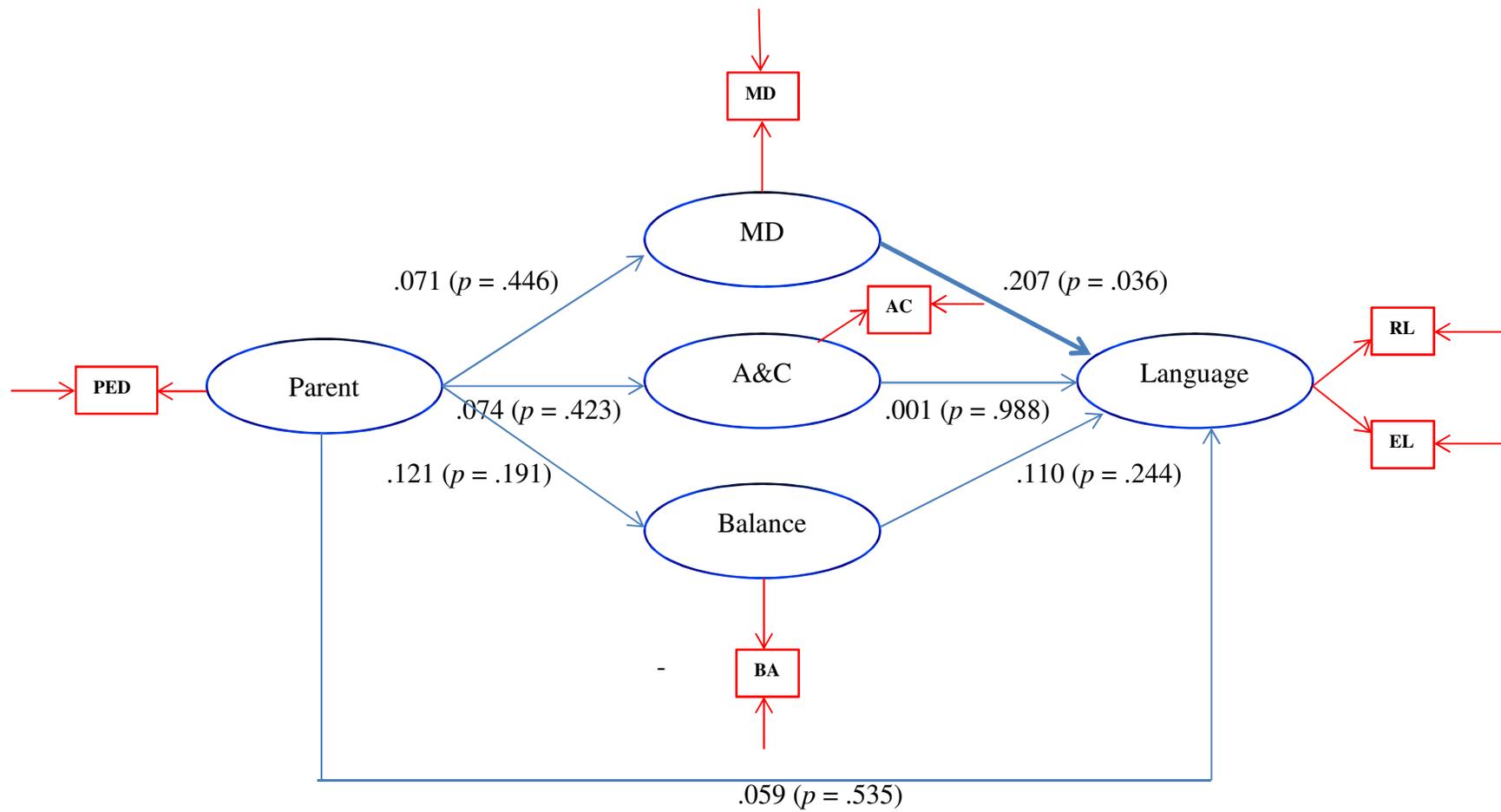


Figure 5.3. Model 3: Measurement model (in red) and structural model (in blue). PED = permissive discipline; MD = manual dexterity; A&C = aiming & catching; BA = balance; RL = receptive language; EL = expressive language.

Table 5.11

*Correlations among Latent Variables in Model 3*

	Parent	MD	A&C	Balance	Language
Parent	1.000				
MD	0.056	1.000			
A&C	0.065	0.325 **	1.000		
Balance	0.113	0.396 **	0.194 *	1.000	
Language	-0.033	0.237 **	0.068	0.169	1.000

Parent = permissive discipline; MD = manual dexterity; A&C = aiming and catching; Language = receptive and expressive language.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

#### **5.3.4.4 Summary for Models 1, 2 & 3 Results.**

Models 1, 2 and 3 revealed that the path from motor development (Manual Dexterity) to language (Receptive and Expressive Language) was significant. All other hypotheses were not supported. Model 2 indicated that although the component pathways from parenting to manual dexterity and from manual dexterity to language were both significant, these effects were not strong enough to carry the effect of parenting through manual dexterity to language.

## **5.4 Discussion**

Although past studies have consistently shown that there are relationships between parent-child interactions, and motor and language development, limited research has been undertaken to understand the nature of these relationships. The present study aimed to advance our knowledge of these relationships by testing three mediation models. The child's age, mother's age and education level, family income and ethnicity were controlled in all three models.

Modest relationships were found between the latent variables across Models 1 (ranging from .013 to .396), 2 (.073 to .396), and 3 (ranging from .033 to .396), suggesting that the strength between latent variables was weak. This is consistent with the results that did not support the mediation modelling as predicted in the present study. In particular, the prediction that motor development mediated the relationship between parenting behaviours and language outcomes, was not supported.

#### **5.4.1 Model 1 (Punitive Discipline, Autonomy Support, Democratic Discipline).**

Model 1 indicated that there was a significant relationship between fine motor skills (specifically Manual Dexterity) and language (specifically Receptive and Expressive Language) development. These findings support the existing literature that motor development and language outcomes are correlated (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Oller et al., 1999; Viholainen et al., 2006; Vukovic et al., 2010). All other hypotheses were not supported, in particular, the prediction that both fine and gross motor skills mediated the relationship between parenting behaviour and language development.

The findings were also inconsistent with past research that suggests parental disciplinary strategies (as measured by Punitive Discipline, Democratic Discipline, and Autonomy Support) have significant impact on children's development (Barber, 2002; Baumrind, 1991; Capaldi & Patterson, 1994; Dadds et al., 2003; Dornbusch et al., 1987; Elmen, 1991; Grolnick et al., 1991; Grolnick et al., 2002; Grusec & Goodnow, 1994; Morrison et al., 2003; Patterson, Reid, & Dishion, 1992; Shek et al., 1998; Smetana, 1995; Steinberg et al., 1994). Interestingly, Punitive Discipline was found to be negatively correlated with Manual Dexterity (-.180) and Receptive Language (-.159).

In this study, punitive discipline scores fell within narrow ranges (3 to 6). Thus a ceiling effect may have occurred, a condition in which most of the participants scored at or near the upper limits. Similarly, narrow ranges and negative skew were also found with scores for autonomy support (3 to 6) and democratic discipline (3.6 to 6). Consequently, it is possible that false-negative outcomes could have occurred because of the ceiling effect, making the measurement (PBDQ) intrinsically less

sensitive in detecting changes (Lam, Young, Marwaha, McLimont, & Feldman, 2004). In addition, the present study examined the individual construct of PBDQ rather than the cumulative Total PBDQ score in predicting a child's developmental outcomes, which could have affected the specificity and predictive ability of this measure (Reid, 2012).

Another plausible explanation as to why parental disciplinary strategies were not a significant predictor of children's development outcomes is due to the different age groups. Past studies have also shown that the use of punitive parenting strategies such as yelling and spanking peaks in early childhood between the ages of two and three years ("terrible twos") and decreases over time (Day, Peterson, & McCracken, 1998; Kopp, Regalado, & Halfon, 2000; Regalado, Sareen, Inkelas, Wissow, & Halfon, 2004). Thus, as our sample of children approaches age four years and beyond, it is plausible that parents could have used less punitive discipline strategies. This assumption is consistent with the narrow range of scores (3 to 6) on the punitive discipline subscale, indicating that parents in the present study are less likely to use punitive discipline with their children.

Interestingly, the results of this study supported past research that indicated parental disciplinary strategies such as autonomy support has no significant impact on children's outcomes. According to Deci and Ryan's (1985, 2000) self-determination theory, the benefits of autonomy support or providing choice can be viewed not as a motivational outcome, but rather as a motivating experience in and of itself. Therefore, when autonomy support was offered, it is possible that such parenting behaviours did not facilitate children's developmental outcomes. Moreover, early developmental researchers view autonomy support to be most critical in adolescents rather than younger children, particularly in the separation-individuation process (Blos, 1979; Levy-Warren, 1996). This is consistent with past research that shows autonomy support was unrelated to adjustment, particularly in younger children (Lopez, Campbell, & Watkins, 1989), indicating that autonomy support may be related to the child's age.

Another plausible explanation as to why parental disciplinary strategies did not support children's language development is that lexical development relates to the child's vocabulary acquisition in both comprehension and production (McCarthy,

1954). According to the social-pragmatic perspective, a child's word knowledge is strongly supported by the frequency, mutual engagement and joint communication with adults (Bruner, 1974, 1975; Pinker, 1984; Tomasello, 2000, Tomasello & Todd, 1983). Therefore, it is possible that when children are constantly exposed to a well-structured learning environment with adults (with both parents and teachers), this could support the occurrence of positive interactions, which in turn, facilitate children's language development. Such assumption is consistent with past studies that reveal both parent-child and teacher-child interactions are correlated with children's later reading skills (Dickinson & Tabors, 2001; Tabors, Beals, & Weizman, 2001). However, the effect of the child's teacher or other adult on children's language development was not teased out in the present study.

#### **5.4.2 Model 2 (Emotional Warmth).**

Model 2 indicated that the indirect effect was non-significant, in which motor development (specifically Manual Dexterity) has failed to mediate the relationship between parenting behaviours (specifically Emotional Warmth) and language (specifically Receptive and Expressive Language) outcomes. In contrast, the path from Emotional Warmth to Manual Dexterity was significant. These findings have reinforced past studies where parental warmth is related to children's developmental outcomes (Davidov & Grusec, 2006). Similarly, the path from Manual Dexterity to Receptive and Expressive Language was also significant, suggesting that children's fine motor skills were associated with language outcomes. The results supported the existing literature that motor development is related to children's language development (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Oller et al., 1999; Viholainen et al., 2006; Vukovic et al., 2010; Wang et al., 2014).

Although the path from Emotional Warmth to Manual Dexterity was significant, it was negative, indicating that a higher level of parental warmth is related to a lower level of fine motor skills. Although it is inconsistent with other research, an earlier study reported a similar relationship, in which greater degrees of maternal warmth and emotional responsiveness were associated with less optimal motor development with 12 months old premature infants (Pridham, Brown, Clark, Sondel, & Green, 2002). According to Pridham et al. (2002), this could be attributed to low internal

consistency or agreement amongst raters in the parenting measurement used (HOME; Caldwell & Bradley). Similarly, a recent study revealed that an increase in parental negative affect was associated with better motor development in early preterm children (Treyvaud et al., 2009). Displays of negative affect by parents in this study are reflected by using a firm voice or saying “no” frequently. Treyvaud et al. (2009) speculates that such firm and restrictive parenting represents a parenting behaviour that values and promotes activity and motor development.

In the present study, the Emotional Warmth score was negatively skewed with a narrow range (4.17 to 6), indicating a ceiling effect might have occurred. Furthermore, eight mothers did not endorse item 12 that states: “I show my child that I love them unconditionally”. Similar comments such as “not sure what you are asking” were written next to this item by mothers who did not endorse this item. In addition, displays of parental emotional warmth include questions such as “I show an interest in my child’s life” and “I recognise my child’s strengths and talents”. Although the emotional warmth factor in the PBDQ is consistent with the dimension of warmth, love, or acceptance as suggested by Reid (2012), these questions could be highly subjective to parent’s beliefs and values in their parenting role. Thus the inconsistent findings in this study could be attributed to limitations identified in the PBDQ.

#### **5.4.3 Model 3 (Permissive Discipline).**

Model 3 indicated that there was a significant relationship between fine motor skills (specifically Manual Dexterity) and language (specifically Receptive and Expressive Language) development. These findings support the existing literature that fine and gross motor skills and language outcomes are interrelated (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Oller et al., 1999; Viholainen et al., 2006; Vukovic et al., 2010). All other hypotheses were not supported. Also contrary to our hypothesis, the findings did not provide evidence for the relationship between Permissive Discipline, and motor or language outcomes. In particular, the prediction that motor development (Manual Dexterity, Aiming and Catching, and Balance) had a mediation effect on the relationship between parenting behaviour (specifically Permissive Discipline) and language (Receptive and Expressive Language) development was not supported. This is inconsistent with past

studies that reveal permissive parenting or inconsistent discipline is negatively related to children's developmental outcomes (Baumrind, 1996, 1997; Capron, 2004; Deci & Ryan, 1987; Essau et al., 2006; Wells et al., 2000).

The sample in this study predominantly consisted of mothers with a university degree or higher (61.80%) and families with higher income (64.50%), thus it is possible that conformity and compliance in children are highly valued by parents. This assumption is supported by past research that demonstrates family incomes are related to the extent to which parents value conformity, which in turn, influenced their beliefs about discipline (Luster, Rhoades, & Haas, 1989). Mothers from lower income families, for example, tended to believe that their children should not be spoiled, and in turn, displayed lower degrees of parental warmth and involvement towards their children (Luster et al., 1989). This assumption is consistent with existing literature that shows permissive discipline was negatively related to African-American mothers from lower levels of education attainment and lower family incomes (Bluestone & Tamis-LeMonda, 1999; Dornbusch et al., 1987). Thus it is possible that the demographic characteristics in this study, that included mothers with higher education level and higher family incomes, could have contributed to the inconsistent findings in this study.

This is supported by the results that showed the Permissive Discipline score was negatively skewed within a narrow range, indicating that the majority of parents in the present study reported that they were less likely to use permissive discipline. This notion is supported by past research that demonstrates less optimal parenting behaviours such as neglect, harsh and punitive discipline, are difficult to observe and commonly underrepresented (Driscoll, Russell, & Crockett, 2008; Gaylord-Harden, Campbell, & Kesselring, 2010; Kapinus & Gorman, 2004; Landry, Smith, & Swank, 2006; Lieb et al., 2000; Lorber, O'Leary, & Slep, 2011; Mahoney, Donnelly, Lewis, & Maynard, 2000; Mallinckrodt, 1992; Spokas & Heimberg, 2009).

#### **5.4.4 Impact of control variables in parenting behaviours.**

In this study, mother's age and educational level, family income and ethnicity were related to different parenting behaviours, including Punitive Discipline, Autonomy Support, and Permissive Discipline. In particular, mother's age was positively correlated with Autonomy Support, indicating a trend for increased

positive parenting behaviours with increasing mother's age. These findings have reinforced past research that shows mother's age significantly influences parenting behaviours (Berlin, Brady-Smith, & Brooks-Gunn, 2002; Bornstein, Putnick, Suwalsky, & Gini, 2006; McFadden & Tamis-LeMonda, 2013). Furthermore, less optimal parenting behaviours that involve negative and intrusive controlling parenting are found to be more prevalent with younger mothers when compared to older mothers (Berlin et al., 2002; Culp, Appelbaum, Osofsky, & Levy, 1988). In this sample, mother's age ranged between 24 to 48 years with a mean age of 37 years. Therefore, the findings in this study supported the assumption that positive parenting behaviours may be related to older mothers.

Furthermore, mother's educational level was also positively correlated with Autonomy Support. The findings have added to existing literature that mother's education may be related to parenting behaviours (Tamis-LeMonda et al., 2008). Parents with higher education levels are also positively associated with higher family incomes (Coleman & Karraker, 2004; Smetana, 2000). In this study, family incomes were positively related to Punitive Discipline (reverse scored) and Autonomy Support. This result has added to past research that parenting behaviours may be influenced by family incomes (Chazan-Cohen et al., 2009; Lugo-Gil & Tamis-LeMonda, 2008; McFadden & Tamis-LeMonda, 2013; McLoyd, 1990; Ryan, Fauth, & Brooks-Gunn, 2006;). Therefore, it is possible that mothers with more education would have greater opportunity to learn and understand about parenting (such as from parenting books) because of the available resources.

Mother's ethnic differences was negatively correlated to Punitive Discipline (reverse scored) and Permissive Discipline (reverse scored), indicating that parenting behaviours were related to ethnic differences. The findings in this study have reinforced the existing literature indicating different ethnic groups are related to different parental disciplinary strategies (Brooks-Gunn & Markman, 2005; Davis et al., 2001; Fuligni & Brooks-Gunn, 2013; Kelley, Power, & Wimbush, 1992; Kagitcibasi, 2005; Russell et al., 2003; Schumacher, & Streiet, 1988; Wilson, Kohn, Curry-El, & Hinton, 1995). In particular, mothers from Western cultures (e.g., United States of America and Australia) are more likely to use a Democratic Discipline or authoritative parenting style rather than an authoritarian parenting style

(Russell et al., 2003). This assumption is consistent with the findings in the present study, suggesting that the majority of mothers who participated in this thesis have identified that they are more likely to use Democratic Discipline rather than Punitive Discipline.

#### **5.4.5 Limitations.**

Whilst the present study has added to the existing literature that motor development could facilitate and support language outcomes, the limitations of the present study warrant discussion. First, this study utilised a normative sample of mothers and their typically developing children aged four to six years, thus limiting the generalisability of this study to other populations. Further limitation includes the disposition of mothers and their children that could have contributed to parenting behaviour, such as a mother's history of depression and the child's temperament, were not investigated in the present study. Furthermore, the present study was not designed to establish cause-and-effect relationships, although our hypothetical causal model does account for the correlation data. Moreover, the low internal consistency reliability for the motor measure may be part of the reason why motor skills did not correlate with the parenting measure. In particular, Aiming and Catching and Balance subscales yielded a Cronbach's alpha of .45 and .47 respectively.

#### **5.4.6 Summary.**

Taken together, the results in Models 1, 2 and 3 consistently demonstrated that there was a significant relationship between motor development (Manual Dexterity) and language outcomes (Receptive and Expressive Language). The specific relationship found between motor development and language outcomes may be accounted for by a shared underlying neurocognitive mechanism. Some researchers have pointed out that in both reading tasks (Wolf, Bower, & Biddel, 2000) and motor tasks (Ito, 2000, 2006; Wolff, 1993) the cerebellum plays an important role, particularly in temporal organization that involves timing, accuracy, and serial ordering between children with dyslexia and typically developing children.

This assumption is consistent with existing literature that demonstrates motor difficulties are a common occurrence in children with autism, dyslexia, specific language impairment and developmental coordination disorder (Siller & Sigman,

2002, 2008; Viholainen et al., 2006; Wolff, Melngailis, Obregon, & Bedrosian, 1995), including difficulty with handwriting or drawing, as well as difficulty planning and executing other fine motor skills such as gripping and dressing (Smits-Engelsman et al., 2001). Furthermore, the findings in present study also supported the dynamic systems theory that posits occurrences of motor development as a result of shared interactions of multiple systems within the person, task and environment (Lewis, 2000; Thelen, 1989; Thelen et al., 1991). The present findings further establish the importance of motor development in children's language outcomes. More importantly, the findings in the present study also extend our knowledge of the importance in examining children's motor performance, particularly in children who are experiencing language difficulties. Assessment of motor performance could provide valuable insights given research demonstrating a high degree of comorbidity between motor and language deficits.

Although the findings presented in this study partially supported one of the hypotheses, namely that there is a significant linkage between motor development and language outcomes in young children, all other hypotheses in this study were not supported. The inconsistent findings in the present study may have been attributed to different measurement approaches. For example, observations of parents (Cole & Rehm, 1986), child reports (Capaldi, 1991), and retrospective reports (Burbach & Borduin, 1986) have all been used in past studies, and these approaches have consistently demonstrated that parental warmth, for example, has a positive impact in children's outcomes, whereas the current study relied on parent reports in this construct. According to past research, a single informant, such as a self-report approach, often underestimated the magnitude of the relationship between parenting and children's outcomes (McLeod, Weisz, & Wood, 2007a; McLeod, Wood, & Weisz, 2007b), but it is also highly susceptible to social desirability bias (Bornstein & Xlotnik, 2008; Paulhus, 1991). Thus to overcome some of the methodological issues related to the self-report approach, the next chapter presents a systematic observational method to assess the dynamics and complexity of parent-child interactions.

## Chapter 6

### Study 2

#### 6.1 Overview

Extending from the findings of Study 1, the present study (Study 2) measured parent-child interactions by using an observational method to investigate the possible linkages between parenting behaviours, and motor and language development. The observational approach has the appeal of ecological validity and is considered to be a direct, objective and reliable method for assessing parenting behaviours (O'Connor, 2002). Consequently, observational methods have frequently been used by researchers and clinicians in parenting research (Forehand & McMahon, 1981; Patterson, 1982). Using this approach, positive parental behaviours such as responsiveness (Landry et al., 2001), sensitivity (Barnett et al., 2012), and directiveness (Cress et al., 2008), have been identified as significant predictors of language and motor functioning. More importantly, stemming from these observational studies, researchers and clinicians recognise and support the facilitation of parent-child interaction as a part of early intervention programmes for young children (Kaminer & Robinson, 1993).

Whilst much of the existing literature in parenting utilised observational methods to measure parent-child interactions, several issues related to the methodology were noted. For example, the presence of an observer or experimenter, the artificial setting (in the laboratory) and parent-child interactions that were coded based on a specific task or activity might not reflect typical interactive behaviours between parents and their children. In addition, some studies employed different lengths of time in both videotaped and coded parent-child interactions, as well as employing multiple dyads including caregiver-child, father-child and mother-child in the same study (Cress et al., 2008; Magill-Evans & Harrison, 1999, 2001; Treyvaud et al., 2009). Such variation could compromise the study's validity (such as construct and ecological validity) and reliability (particularly test-retest reliability). More importantly, an unstandardised protocol might produce unreliable observational measures.

Thus in the present study, a series of strict protocols have been identified to eliminate variance in the observed parenting behaviours. First, during a 20 minute period of parent-child free play, the session was videotaped with no observer present, to ensure that the actual parent-child interaction was not hampered by the presence of a stranger (Bornstein et al., 2000). Second, five minutes of warm-up was included to ensure that the mother and child were at ease and to provide the opportunity for both the mother and her child to adjust to the activities (Eyberg, Nelson, Duke, & Boggs, 2005). Parent-child interactive behaviours were coded during 10 of the 20 minutes. The reduced time needed to complete the observations would reduce potential stress and fatigue on the mother-child dyads (Shanley & Niec, 2010). Third, only mothers were selected in this study to reduce sampling variability within participants (Cronbach, Linn, Brennan, & Haertel, 1997, p. 385). This is consistent with previous studies that suggest there is a significant difference between mother-child and father-child interactions (Lindsey & Caldera, 2006). Fourth, a free-play session was used to elicit spontaneous and natural interaction between the parent and child (Aspland & Gardner, 2003; Gardner, 2000). Fifth, the video session was carried out at the child's home without artificial surroundings (Aspland & Gardner, 2003; Bornstein et al., 1999; Cress et al., 2008; Gardner, 2000; Gilmore et al., 2009). As suggested by Gardner (2000), observational methods in a natural setting generate behavioural measures with high levels of construct validity because such observations often represent actual day-to-day interactive behaviours between parents and their children.

Although observational approaches have been commonly used by researchers and clinicians to examine the relationships between parent-child interactions and developmental outcomes, the parenting literature has focused on children in their infancy and toddler stages. In addition, limited investigations have been conducted to examine the influence of parent-child interaction in children's motor development. More importantly, although previous studies have provided evidence that parenting behaviours, motor and language development were linked, limited research has been undertaken to determine how these linkages operate, particularly in typically developing children beyond the toddler years.

Given the validity and reliability of observational methods, Study 2 used the Maternal Behavior Rating Scale Revised (MBRS-R; Mahoney, 2008) to measure parent-child interactions; the MBRS-R has been shown to identify parenting behaviours that are related to children's developmental outcomes such as children's intellectual, language and social development (Mahoney et al., 1986). The MBRS-R has been systematically developed from established global maternal rating scales of child development to provide global ratings of 12 different qualities of parenting behaviours (Mahoney et al., 1998; Mahoney & Powell, 1988). In Study 2, standardised protocols were strictly followed so that the observed parent-child interactions were representative of typical behaviours when mothers interacted with their children at home. This is important because a standardised protocol is necessary for providing robust and accurate indicators of the parenting behaviours measured (Aspland & Gardner, 2003; Gardner, 2000).

The aim of Study 2 was to determine whether motor development significantly mediated the relationship between parenting behaviours and language development in typically developing children aged between four to six years by using an observational measure, namely, the MBRS-R. Potential confounding variables including child's sex, age, verbal and non-verbal IQ, as well as mother's age and level of education, family income and ethnicity were controlled. In Study 2, it was hypothesised that:

- (1) Parenting behaviours of responsiveness, affect, achievement and directiveness will be significant predictors of a child's receptive and expressive language development.
- (2) Parenting behaviours of responsiveness, affect, achievement and directiveness will be significant predictors of a child's motor development.
- (3) Maternal characteristics such as age, level of education, ethnicity and family income will be significantly associated with different qualities of parenting behaviours towards the child.
- (4) A child's sex, age and verbal and non-verbal IQ will be significantly associated with parenting behaviours.

(5) Motor skills will mediate the relationship between parenting behaviours and receptive and expressive language development in children aged four to six years.

It should be noted from the outset that Study 2 (like Study 1) uses cross-sectional correlational data and therefore cannot be used to establish cause-and-effect relationships; but to ascertain whether they are consistent with a causal model in which parenting behaviours impact motor and language development.

## **6.2 Method**

### **6.2.1 Participants.**

Mothers in Study 1 who consented to participate in a 20-minute mother and child free-play session at home were recruited for Study 2. Three mothers were excluded because their children were diagnosed with learning difficulties. The final sample size included 84 mothers aged 25 to 45 years ( $M = 37.33$ ,  $SD = 4.23$ ), and their children aged four to six years eleven months ( $M = 4.68$ ,  $SD = 0.71$ ). There were 50 boys (60%) and 34 girls (40%), of which 41 (49%) children attended kindergarten, 32 (38%) attended pre-primary, and 11 (13%) attended Year 1.

The majority of the mothers who agreed to participate in the 20 minutes free-play session were married (93%), indicated that their ethnic identity was Australian (77%), and were highly educated, with 87% having completed a Bachelors degree or a higher degree. In addition, 86% of participants indicated that their household family income exceeded AUD\$80,000 yearly. Table 6.1 presents demographic information for mothers and families.

Table 6.1

*Demographic Information for Mothers and Families for Study 2 (N = 84)*

	<i>n</i>	<i>%</i>
<b>Mother's Marital Status</b>		
Single	1	1.20
Married/Defacto	78	92.90
Separated	1	1.20
Divorced	4	4.80
<b>Mother's Highest Level of Education</b>		
High School Years 8 to 10	1	1.20
High School Years 11 to 12	4	4.80
Apprentice/Technical	3	3.60
Diploma	3	3.60
University Degree	62	73.80
University Postgraduate	11	13.10
<b>Mother's Ethnic Identity</b>		
Australian	65	77.40
North and West European	7	8.30
Southern European	1	1.20
Asian	7	8.30
White South African	4	4.80
<b>Household income</b>		
AUD\$80,000 and above	72	85.70
AUD\$50,000 to AUD\$79,000	5	6.00
AUD\$30,000 to AUD\$49,000	4	4.80
AUD\$30,000 and below	2	2.40
Not Stated	1	1.20
<b>Number of children (in family)</b>		
1 child	5	6.00
2 child	55	65.50
3 children	16	19.00
More than 3 children	1	1.20
Not Stated	7	8.30

### 6.2.2 Measures.

As in Study 1, standardised assessments included motor (MABC-2; Henderson et al., 2007), language (CELF PRE-2; Wiig et al., 2006), and cognitive (WPPSI-III, Wechsler, 2004) tests, as well as the Parenting Questionnaire (demographic information; see Appendix G).

The Maternal Behavior Rating Scale Revised (MBRS-R; Mahoney 2008; see Appendix L) provides global ratings of 12 features of maternal behaviour that are significantly associated with children's development (Mahoney et al., 1998; Mahoney & Powell, 1988). Through factor analysis, the MBRS-R is categorised into four subscales: (a) Directiveness (as measured by directiveness and pace); (b) Responsiveness (as measured by effectiveness, responsiveness, and sensitivity); (c) Achievement Orientation (as measured by achievement and praise); and (d) Affect (as measured by acceptance, enjoyment, expressiveness, inventiveness, and warmth). Table 6.2 provides the definitions of the 12 observed behaviours covered in the MBRS-R's training manual. Composite scores are obtained by summing the scores for all items on each subscale. Each item is rated on a five-point Likert scale with a rating of 1 indicating a "*low incidence of behaviour*", whilst a rating of 5 indicates a "*high incidence of behaviour.*" A high score indicates positive interactional behaviour by the mother with her child. In Study 2, the Cronbach's alpha for each subscale was .85 for responsiveness, .91 for affect, and .74 for achievement orientation, indicating good internal consistency reliability. However, directiveness subscale yielded a Cronbach's alpha of .44, suggesting modest correlation between the items (directiveness and pace) measured in the same subscale, the Cronbach's alpha across the four subscales was .77.

Table 6.2 removed

### 6.2.3 Procedure

Participants from Study 1 were invited to participate in a 20-minute mother-child free-play session at home. Prior arrangement was made to videotape a 20-minute segment of the mother-child interaction. Each video session followed a strict standardised protocol in order to eliminate variance that may compromise the validity and reliability of observed parent-child interactions. This included an

unstructured free-play session of a mother-child dyad that lasted for 20 minutes at home, without the presence of an experimenter or observer. In addition, five minutes of warm-up session was provided to ensure that the mother and child were at ease with the video recording, as well as to provide the opportunity to adjust to the environment and tasks (Eyberg, Nelson, Duke, & Boggs, 2005). The mother and child interactive behaviours were systematically coded during 10 of the 20 minutes videotaped. With the mother's guidance, each child was encouraged to use different toys (Lego and play dollhouse) and activities (jigsaw puzzles and craft works) before and during the play session to support engagement in different play activities that involved exploration, communication, pretend play and problem solving.

Each mother was asked to play with the child's favourite toys or engage in activities and to play as she would normally play with her child at home. These interactions were rated using the MBRS-R. The MBRS-R's detailed training manual was obtained directly from the author, Professor Gerald Mahoney at University of Case Western, USA. In accordance with the MBRS-R's training manual, no specific instructions or coaching on how the mother or child should play with the toys were provided. The video session was discontinued when there was an interruption such as when the mother needed to attend to another sibling's needs, then resumed later. Only two mother-child dyads were interrupted during the video sessions; one of the children needed to go to the toilet whilst the mother of the second child had to leave for five minutes to prepare a snack for a younger sibling. When the video session resumed, both mother-child dyads were observed to be comfortable and played as normal throughout the remaining video session.

#### ***6.2.3.1 Interrater reliability.***

In order to establish interrater reliability, three fourth year Psychology students were trained in accordance with the training manual to serve as independent raters of the mother-child free-play interaction. In the MBRS-R's training manual, maternal behaviour is described by a general definition, a series of examples for each behaviour and specific guidelines to assist discrimination between ratings. Initial training, which took four hours, established a general understanding of the MBRS-R's procedures, and provided instruction in specific processes of systematic observation, and training in response definitions of specific behaviour observed.

During this training, definitions and clarifications of observed behaviours were discussed.

There were two phases involved in establishing interrater reliability. Except for the author, all three raters had no knowledge of the mother or the child's background. In Phase 1, five videotapes were randomly selected and systematically coded by three raters who were trained by the author. The training included watching five videotapes together, then each rater rated each videotape individually and discussed the ratings for each videotape. Phase 1 involved a total of 14.50 training hours. Following this, in Phase 2, interrater agreements were tested using 20 (23%) additional videotapes that were randomly selected from the total sample of 87 videotapes. These videotapes were rated independently by all four raters (the three student raters and the author). Interrater reliability was derived from each rater's scores across all four MBRS-R subscales. After establishing the interrater reliability, the remaining 67 videotapes of mother-child interactions were systematically coded by the author.

#### **6.2.4 Statistical analyses.**

In the present study, data were analysed with the Statistical Package for the Social Sciences (SPSS Version 19). The intraclass correlation coefficient (ICC) was used to assess interrater reliability. ICC calculates the ratio of variance due to raters compared with the total variance. As all three independent raters were volunteers in this study rather than selected by random sampling, a two-way mixed model was used. The priori level of acceptable interrater reliability was set at an ICC of greater than .75 for each MBRS-R subscale (Landis & Koch, 1977). This was followed by a one-way repeated measure analysis of variance to examine variances between raters (four levels) and MBRS subscales (four levels). Differences between raters were formally analysed by computing the *F*-statistic and the related probability value. The level of statistical significance was set at .05.

The analysis testing the main hypotheses consisted of seven steps. Step 1 was concerned with assessing the interrater agreement for the MBRS-R. Step 2 was concerned with computing descriptive statistics including means, standard deviations and ranges for each of the study variables. Step 3 involved testing the assumptions underlying Pearson's correlations such as normality and linearity. On Step 4,

bivariate correlations were computed between study variables (Responsiveness, Affect, Achievement Orientation, Directiveness, Manual Dexterity, Aiming and Catching, Balance, Receptive Language and Expressive Language) and potential control variables (child's sex, child's age, mother's age, family income, mother's educational level, ethnicity, verbal IQ, and non-verbal IQ). On Step 5, the bivariate correlations among the study variables - and their corresponding partial correlations (partialling out the influence of the significant control variables identified on Step 4) - were computed. Step 6 involved testing the assumptions underlying structural equation modelling such as the absence of multicollinearity and multivariate normality. On Step 7, structural equation modelling using LISREL (Version 8.54; Jöreskog, & Sörbom, 2004) was conducted on the Step 5 partial correlations to determine whether motor development mediates the relationship between parenting behaviours and language development.

## **6.3 Results**

### **6.3.1 Interrater reliability.**

The means, standard deviations and percentages of total agreement between raters for each subscale in the MBRS-R are presented in Table 6.3. The interrater agreement was calculated by a simple formula:  $[\text{Per cent Agreement} = \text{Number of Agreements} / (\text{Number of Agreements} + \text{Disagreements})] \times 100$  (Kim & Mahoney, 2005). Interrater agreement was 95% for the Responsiveness subscale, 83% for the Affect subscale, 88% for the Achievement Orientation subscale, and 90% for the Directiveness subscale. This exceeded the interrater agreement of 80% recommended by Kim and Mahoney (2004). However, to make sure that the percentage of agreements between raters was not inflated due to chance, ICC and analysis of variance was performed.

Table 6.3

*Means and Standard Deviations for MBRS-R Subscales Rated by Each Rater and Agreements between Raters (N = 20)*

Scale	Mean (SD)				Agreement between Raters
	Rater 1	Rater 2	Rater 3	Rater 4	
MBRS-R responsive	4.32 (0.55)	4.37 (0.53)	4.30 (0.56)	4.25 (0.66)	95.00
MBRS-R affect	3.28 (0.51)	3.15 (0.47)	3.20 (0.50)	3.17 (0.48)	82.50
MBRS-R achievement orientation	3.08 (0.52)	2.98 (0.53)	3.05 (0.43)	3.05 (0.48)	87.50
MBRS-R directiveness	3.08 (0.44)	3.05 (0.56)	3.13 (0.39)	3.08 (0.37)	90.00

*Notes:* MBRS-R = Maternal Behaviour Rating Scale Revised.

### 6.3.1.1 Intraclass correlation coefficient.

Table 6.4 provides the ICCs and their 95% confidence intervals (CI) for the MBRS-R subscales. Landis and Koch (1977) have deemed that ICC values greater than .75 are excellent,  $r$  values between .40 and .75 are fair to good, and values less than 0.40 are poor.

As can be seen in Table 6.4, the ICC values for Responsiveness, Affect, Achievement Orientation and Directiveness were all greater than .75 indicating excellent agreement among the four raters. The narrow CIs indicate high levels of precision in the ICC estimations.

Table 6.4

*Intraclass Correlation Coefficient and Confidence Interval of MBRS-R Subscales (N = 20)*

Subscale	ICC	95% CI
MBRS-R responsiveness	.960	.922, .983
MBRS-R affect	.964	.926, .983
MBRS-R achievement orientation	.910	.826, .961
MBRS-R directiveness	.918	.842, .965

Notes: MBRS-R = Maternal Behavior Rating Scale Revised.

### 6.3.1.2 Analysis of variance.

A one-way repeated measures analysis of variance was performed to ascertain whether there were significant differences among raters in terms of their MBRS-R subscale scores. Results showed no statistically significant difference between raters on Responsiveness ( $F(3, 17) = .110, p = .953$ ), Affect ( $F(3, 17) = .198, p = .896$ ), Achievement Orientation ( $F(3, 17) = .576, p = .639$ ), and Directiveness ( $F(3, 17) = .693, p = .569$ ). The results indicated that the ratings across the four subscales were consistent between raters. In summary, the percentage of total agreement between raters, ICC and analysis of variance showed high interrater reliability for the MBRS-R.

### **6.3.2 Descriptive statistics.**

The means, standard deviations, and ranges for the subtests measuring parenting behaviour, and motor and language development are presented in Table 6.5. The parenting behaviour (MBRS-R) scores were obtained by summing item scores in each subscale. The results showed that all five subscales for parenting behaviour fell within a normal range of scores (1.50 to 5). The MABC-2, in addition to the three different indicators of motor difficulty reported in Table 6.5, provided a mean total score of 80.95 ( $SD = 11.47$ ; range 49 to 109). In the present study, two (2%) children scored 49 and 55 respectively (regarded as having significant movement difficulty), eight children (10%) scored from 57 to 67 (regarded as at risk of having movement difficulty), although none had previously been diagnosed with a motor disorder. The remaining 74 (88%) children scored from 68 to 109, indicating that no motor difficulty was detected.

Table 6.5

*Means, Standard Deviations, and Ranges for the Study Variables (N = 84)*

Scale	Mean	SD	Range
MBRS-R responsive <sup>a</sup>	4.23	0.69	2.33 – 5.00
MBRS-R affect <sup>a</sup>	3.75	0.71	2.00 – 4.80
MBRS-R achievement orientation <sup>a</sup>	3.49	0.76	1.50 – 5.00
MBRS-R directiveness <sup>a</sup>	3.02	0.44	2.00 – 4.50
MABC-2 manual dexterity <sup>b</sup>	9.90	2.87	2 – 18
MABC-2 aiming and catching <sup>b</sup>	9.98	3.30	1 – 19
MABC-2 balance <sup>b</sup>	11.61	3.22	5 – 18
CELF PRE-2 receptive language <sup>c</sup>	103.37	12.62	66 – 128
CELF PRE-2 expressive language <sup>c</sup>	104.99	13.60	61 – 140
WPPSI-III performance index quotient <sup>d</sup>	99.88	14.65	73 – 132
WPPSI-III verbal index quotient <sup>d</sup>	109.17	13.33	72 – 141

*Notes:* MBRS-R = Maternal Behavior Rating Scale Revised; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2; WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-III.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b</sup> Scaled score.

<sup>c,d</sup> Age-standardised score.

The core language scores ( $M = 104.06$ ;  $SD = 13.73$ ; range scores of 55 to 136) from the measure of language (CELF PRE-2) are used to describe different levels of language abilities and difficulties. The results showed that two (2%) children scored 55 and 59 respectively, indicating performance in the Very Low range (regarded as having severe language impairment); three (4%) children scored between 75 and 77, indicating performance in the Moderate range (regarded as having language impairment); and one child (1%) scored 82, indicating performance in the Borderline range (regarded as at risk of having a language impairment). None of these children

had previously been diagnosed with a language disorder. Another 63 (75%) children scored between 86 and 114 indicating that language proficiency was in the Average range, whereas the remaining 15 (18%) children scored between 116 and 136 indicating that their language proficiency was Above Average in comparison to their same-aged peers.

In the WPSI-III, the VIQ composite scores showed that two (2%) children scored 72 and 74 respectively indicating the Borderline range, five (6%) children scored between 81 and 88 indicating a Low Average range, 42 (50%) children scored between 91 and 109 indicating an Average range, and 35 (42%) children scored between 111 and above 141 indicating a High Average to Very Superior range. The PIQ composite scores revealed that nine (11%) children scored between 73 and 79 indicating the Borderline range, 14 (17%) children scored between 81 and 86 indicating a Low Average range, 34 (40%) children scored between 90 and 107 indicating an Average range, and 27 (32%) children scored between 112 and above 132 indicating a High Average to Very Superior range.

### **6.3.3 Assumption testing for Pearson's $r$ .**

The Pearson correlation assumes that the variables being correlated are normally distributed, linearly related, and homoscedastic. Each of these assumptions is tested in turn.

#### **6.3.3.1 Normality.**

As suggested by Field (2005), statistics of skewness and kurtosis were converted to z-scores by dividing the skewness and kurtosis values by their respective standard errors (see Table 6.6). Field (2005) recommended a cut-off z-score value of 2.58 for a sample size less than 200. Results indicated that Responsiveness, Receptive Language, and Expressive Language exceeded an absolute value of 2.58 for skewness, kurtosis or both.

The Pearson correlations (which assume normality) were compared to the Spearman correlations (which do not assume normality) to determine the impact of the normality violations reported previously. The pattern of significant correlations was comparable across the two correlation matrices (see Appendix N). It was therefore concluded that the departures from normality shown by some of the

measures had little impact on the reliability of the Pearson correlation. The more versatile Pearson correlation was therefore used for the remainder of the analyses including the structural equation modelling.

Table 6.6

*Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 84)*

	Skewness		Kurtosis	
	Raw Score	z-score	Raw Score	z-score
MBRS-R responsiveness <sup>a</sup>	-1.08	-4.09 <sup>e</sup>	0.76	1.47
MBRS-R affect <sup>a</sup>	-0.44	-1.67	-0.87	-1.68
MBRS-R achievement orientation <sup>a</sup>	-0.38	-1.46	-0.10	-0.20
MBRS-R directiveness <sup>a</sup>	0.47	1.77	1.48	2.85 <sup>e</sup>
MABC-2 manual dexterity <sup>b</sup>	-0.08	-0.30	2.27	0.44
MABC-2 aiming & catching <sup>b</sup>	0.06	0.24	0.67	1.28
MABC-2 balance <sup>b</sup>	0.34	1.29	-0.77	-1.48
CELF PRE-2 receptive language <sup>c</sup>	-0.91	-3.48 <sup>e</sup>	1.17	2.15
CELF PRE-2 expressive language <sup>c</sup>	-0.82	-3.10 <sup>e</sup>	1.99	3.83 <sup>e</sup>

*Notes:* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b</sup> Age-standardised score.

<sup>c,d</sup> Scaled score.

<sup>e</sup> z-score exceeded an absolute value of 2.58.

### **6.3.3.2 Linearity.**

Scatterplots of the bivariate relationships were examined. The nine measures generated 45 bivariate scatterplots. A random selection of 20% ( $n = 9$ ) of the 45 scatterplots showed no obvious curvilinear trends (see Appendix N); linearity was therefore assumed.

#### **6.3.3.3 Homoscedasticity.**

Homoscedasticity between a pair of measures can be tested by conducting a regression analysis with one measure as the dependent variable and the other as the predictor, and then examining the plot of the standardised studentised residuals against the standardised predicted values. Heteroscedasticity is indicated when the points fan out from left-to-right or from right-to-left. A random selection of 20% of the 45 plots showed no obvious fanning out (see Appendix N), suggesting that the assumption of homoscedasticity had not been violated.

#### **6.3.4 Pearson's correlation.**

Bivariate correlations were computed between the study variables (Responsiveness, Affect, Achievement Orientation, Directiveness, Manual Dexterity, Aiming and Catching, Balance, Receptive Language and Expressive Language) and potential control variables (child's sex and age, mother's age and educational level, family income, ethnicity, verbal IQ, and non-verbal IQ). In order to impact the relationships among the latent variables, the control variable needs to be significantly correlated with at least two of the indicators and these indicators need to come from different latent variables. As can be seen in Table 6.7, there were four control variables that satisfied this criterion: Mother's age, ethnic group, and the child's verbal and non-verbal IQ. Pearson correlations among the indicators, and the corresponding partial correlations controlling for mother's age, ethnic group, and the child's verbal and non-verbal IQ are reported in Table 6.8.

Table 6.7

*Pearson's Correlation between Indicators and Potential Control Variables (N = 84)*

	MBRS-R Responsiveness	MBRS-R Affect	MBRS-R Achievement Orientation	MBRS-R Directiveness	MABC-2 Manual Dexterity	MABC-2 Aiming & Catching	MABC-2 Balance	CELF PRE-2 RL	CELF PRE-2 EL
Child's Sex	.173	.199	.119	-.089	.078	.102	.094	.158	.075
Child's Age	-.173	-.078	-.042	-.007	-.076	.051	-.172	-.221 *	-.293 **
Mother's Age	.324 **	.243 *	.183	-.032	.222 *	.052	.174	.393 **	.324 **
Mother's Educational Level	.225 *	.239 *	.215 *	.121	-.006	.045	.127	.054	.103
Family Income	.164	.109	.202	-.007	.002	.070	.141	.212	.272 *
Ethnicity <sup>a</sup>	-.322 **	-.307 **	-.317 **	.108	-.181	.134	-.094	-.213	-.323 **
WPPSI-III PIQ <sup>b</sup>	.531 **	.401 **	.402 **	.142	.185	.104	.092	.525 **	.465 **
WPPSI-III VIQ <sup>b</sup>	.223 *	.223 *	.156	.208	.136	.160	-.032	.340 **	.061

*Note.* MBRS-R = Maternal Behavior Rating Scale Revised; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2; RL = Receptive Language; EL = Expressive Language; WPPSI-III = Wechsler Preschool and Primary Scale of Intelligence-III; PIQ = Performance Intelligence Quotient; VIQ = Verbal Intelligence Quotient.

<sup>a</sup> 1 = Australian, 2 = Others.

<sup>b</sup> Age-standardised score.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

Table 6.8

*Pearson's Correlations between Indicators: First Order Correlations above Diagonal, Partial Correlations below Diagonal (N = 84)*

	MBRS-R Responsiveness	MBRS-R Affect	MBRS-R Achievement Orientation	MBRS-R Directiveness	MABC-2 Manual Dexterity	MABC-2 Aiming & Catching	MABC-2 Balance	CELF PRE-2 RL	CELF PRE-2 EL
MBRS-R responsiveness <sup>a</sup>	<b>1.000</b>	.762 **	.691 **	.080	.304 **	.002	.336 **	.637 **	.599 **
MBRS-R affect <sup>a</sup>	.688 **	<b>1.000</b>	.811 **	-.051	.244 *	.165	.199	.564 **	.475 **
MBRS-R achievement orientation <sup>a</sup>	.594 **	.765 **	<b>1.000</b>	.054	.373 **	.144	.167	.602 **	.591 **
MBRS-R directiveness <sup>a</sup>	.058	-.091	.043	<b>1.000</b>	.182	-.008	.094	.053	.012
MABC-2 manual dexterity <sup>b</sup>	.200	.143	.310 **	.187	<b>1.000</b>	.214	.254 *	.344 **	.231 *
MABC-2 aiming & catching <sup>b</sup>	-.032	.172	.164	-.064	.217	<b>1.000</b>	.058	.053	-.056
MABC-2 balance <sup>b</sup>	.312 **	.156	.121	.117	.223 *	.065	<b>1.000</b>	.240 *	.245 *
CELF PRE-2 receptive language <sup>c</sup>	.470 **	.429 **	.512 **	-.014	.246 *	-.015	.200	<b>1.000</b>	.703 **
CELF PRE-2 expressive language <sup>c</sup>	.415 **	.320 **	.471 **	.015	.220 *	-.074	.181	.627 **	<b>1.000</b>

*Note.* MBRS-R = Maternal Behavior Rating Scale Revised; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>b,c</sup> Scaled score.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

### **6.3.5 Assumption testing for structural equation modelling.**

#### ***6.3.5.1 Multivariate normality and multicollinearity.***

In addition to the assumptions tested above, structural equation modelling also assumes that the nine observed variables are drawn from a multivariate normal population (Kline, 2005). Multivariate normality was violated in the present study ( $\chi^2 = 11.69, p = .003$ ), which means that the chi-square statistic that is normally used to test model fit will be inflated (Jöreskog & Sörbom, 1989). In these circumstances, Jöreskog and Sörbom (1989) recommend testing for model fit with a chi-square statistic that corrects for the inflation. Jöreskog (2004) argues that the Satorra-Bentler chi-square provides such a statistic, and therefore, this was used as the fit statistic at all stages of analysis. Structural equation modelling also assumes that the latent variables are not multicollinear. Multicollinearity exists when there are substantial correlations ( $> .9$ ) among the latent variables. In the present study, the largest correlation among the latent variables was .641, indicating that multicollinearity was met.

#### ***6.3.5.2 LISREL analysis: Structural equation modelling.***

The partial correlations reported below the diagonal in Table 6.8 provided the data for the structural equation modelling analyses. Indicators of the same latent construct should be moderately correlated. The two language indicators (CELF Receptive Language and CELF Expressive Language) satisfied this requirement with a correlation of .627, as did three of the five parenting indicators (Responsive, Affect, Achievement) with correlations ranging between .594 and .755. The other parenting indicator (Directiveness), however, did not correlate with the other three. Responsive, Affect, and Achievement were therefore analysed in the same structural equation model (Model 1), whereas Directiveness was analysed in separate structural equation model (Model 2). Only one of the three motor skill measures, manual dexterity, correlated with *both* the parenting and language measures; the other two motor skill measures, Aiming and Catching and Balance, were therefore dropped from the structural models. Models 1 and 2 have the same structural component, but different measurement components. Model 1, depicted in Figure 6.1, was tested first.

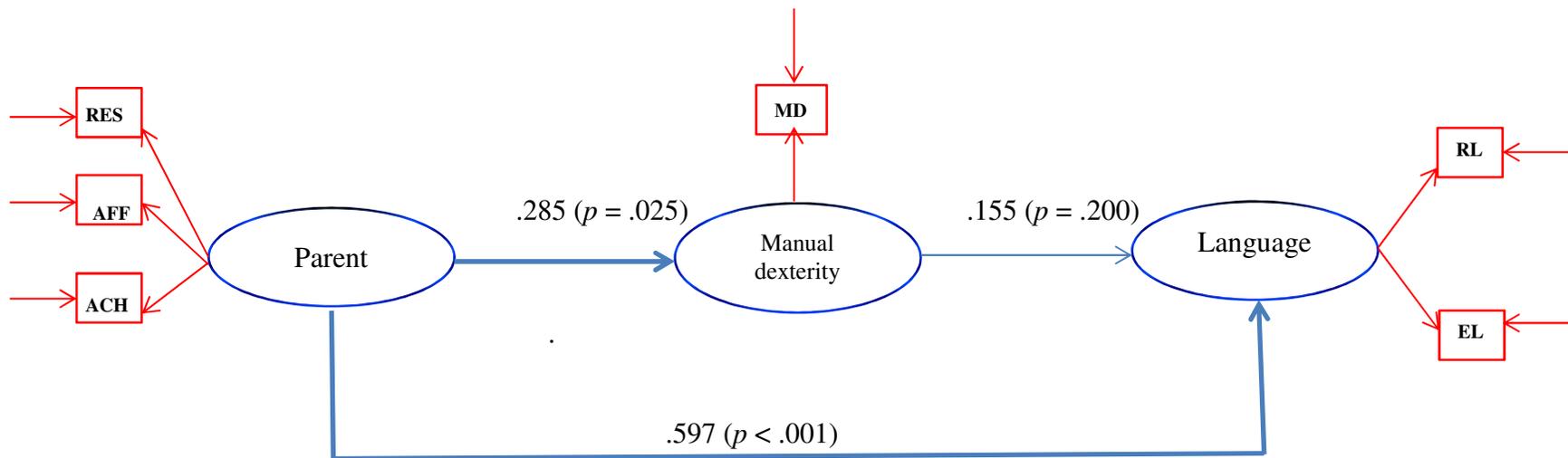


Figure 6.1. Model 1: Measurement model (in red) and structural model (in blue). RES = responsiveness; AFF = affect; ACH = achievement orientation; MD = manual dexterity; RL = receptive language; EL = expressive language.

### **6.3.5.3 Fit indices.**

Study 2, like Study 1, uses a mixture of absolute and relative fit indices to evaluate model fit. Absolute fit indices measure how well a model fits the current data, without a baseline comparison model (Hooper et al., 2008). The first of the absolute indices, and the traditional method, is to assess the chi-square value, in which a non-significant value reflects a good fit. However, for large samples, such as the one investigated in this study, the chi-square is almost always significant (Kenny, 2013). For this reason, the normalised chi-square value (i.e., the chi-square value divided by its degrees of freedom) is more often reported. A normalised chi-square value less than 3 is considered to represent a good fit. Other absolute fit indices include the Root Mean Square Error Approximation (RMSEA) and the Standardised RMR (SRMR). Acceptable model fit is indicated by an RMSEA value of less than or equal to .06 or a 95% confidence interval that straddles this value (Hu & Bentler, 1999; Hooper et al., 2008), and an SRMR value of less than or equal to .08 (Hu & Bentler, 1999; Miller et al., 2007). Both the RMSEA and the SRMR are sensitive to sample size (Hooper et al., 2008).

Incremental or relative fit indices assess model fit by comparing the chi-square to a baseline model in which there are no correlations among the latent variables (Hooper et al., 2008). Relative fit indices include the Normed Fit Index (NFI) and the Comparative Fit Index (CFI). Unlike the NFI, the CFI is not sensitive to sample size. Acceptable model fit is indicated by NFI and CFI values greater than or equal to .9 (Bollen, 1989; Bentler, 1990; Nargundkar, 2008). Byrne (1989) recommends that the CFI should be the primary fit index.

### **6.3.5.4 Model 1.**

In order to reliably test the measurement component of Model 1, it is recommended that a minimum five participants should be recruited for each “free parameter,” although 20 participants per “free parameter” would be preferred (Kline, 2005). The measurement component of Model 1 (see Figure 6.1) has six error variances, six factor loadings, three inter-factor correlations, and three factor variances. According to Kline’s rule-of-thumb, a minimum sample size for testing this system would be 90. Because the measurement component of Model 1 was the most complex system tested in this study, 90 participants served as the recommended

minimum sample size throughout the structural equation modelling analyses. The current sample of 84 fell just short of this requirement.

Fit indices for the measurement component of Model 1 suggest an acceptable fit to the data: the  $\chi^2/df$  ratio was 2.05 ( $\leq 3$ ); the Comparative Fit Index was .961 ( $> .90$ ); the Norm Fit Index was .937 ( $> .90$ ); and the Standardised Root Mean Square Residual was .046 ( $< .08$ ). Although the Root Mean Square Error of Approximation was .112, which has exceeded the desired .06 level and above the more liberal cut-off of .08, Tabachnick and Fidell (2001) point out that because of the tendency to over-reject the true model, this index may be less preferable with smaller samples

Fit indices for the structural component of Model 1 also indicated a good fit: the  $\chi^2/df$  ratio was 2.05 ( $< 3$ ); the Comparative Fit Index was .961 ( $> .90$ ); the Norm Fit Index was .937 ( $> .90$ ); and the Standardised Root Mean Square Residual was .046 ( $< .08$ ), although the Root Mean Square Error of Approximation for the saturated model is more than the desired .06 level and above the more liberal cut-off of .08 (e.g., .112), Tabachnick and Fidell (2001) point out that because of the tendency to over-reject the true model, this index may be less preferable with smaller samples. The fit statistics for both the measurement and structural components of Model 1 are reported in Table 6.9. Both components provide a good fit for the data. The similarity in fit values between the two components reflects their structural similarity.

Table 6.9

*Model 1: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Responsiveness, Affect, and Achievement Orientation), Motor (Manual Dexterity), and Receptive and Expressive Language*

Model 1	$\chi^2/df$	Comparative Fit Index	Normed Fit Index	Standardised Root Mean Square Residual	Root Mean Square Error of Approximation
Measurement model	14.36/7 = 2.05	.961	.937	.046	.112 (90% CI: .016, .195)
Structural model	14.36/7 = 2.05	.961	.937	.046	.112 (90% CI: .016, .195)

CI = confidence interval.

As can be seen in Figure 6.1, the direct pathway from parenting behaviours (as measured by Responsiveness, Affect, and Achievement Orientation) to language development (as measured by Receptive and Expressive Language) was significant, as was the pathway from parenting behaviours to motor development (as measured by Manual Dexterity). The pathway between Manual Dexterity and language outcomes, however, was not significant indicating that the significant relationship between Manual Dexterity and Language (see Table 6.10) is reduced to non-significance in the structural model where parenting is controlled. The non-significance of the pathway from Manual Dexterity to language prevents Manual Dexterity from mediating the relationship between parenting behaviours and language development.

Table 6.10  
*Correlations between Latent Variables in Model 1*

	Parent	MD	Language
Parent	1.000		
MD	0.285 **	1.000	
Language	0.641 **	0.325 **	1.000

*Notes:* Parent = Responsiveness, Affect, and Achievement Orientation; MD = manual dexterity; Language = receptive and expressive language.

\*\*  $p < .01$  (two-tailed).

### **6.3.5.5 Model 2.**

The fit statistics for both the measurement and structural components of Model 2 are reported in Table 6.11. Once again, the similarity in fit values between the two components of the model reflects their structural similarity. The measurement component of Model 2 provided a good fit for the data: the  $\chi^2/df$  ratio was .082 ( $< 3$ ); the Comparative Fit Index was 1.000 ( $> .90$ ); the Norm Fit Index was .996 ( $> .90$ ); the Standardised Root Mean Square Residual was .010 ( $\leq .05$ ); and the Root Mean Square Error of Approximation was .000 ( $< .05$ ). The structural component of Model 2 also provided a good fit for the data: the  $\chi^2/df$  ratio was .082 ( $< 3$ ); the

Comparative Fit Index was 1.000 ( $> .90$ ); the Norm Fit Index was .996 ( $> .90$ ); the Standardised Root Mean Square Residual was .010 ( $< .08$ ); and the Root Mean Square Error of Approximation was .000 ( $< .06$ ).

Table 6.11

*Model 2: Summary of Relevant Model Fit Indices for the Measurement Model and the Structural Models of the Relationship between Parenting Behaviour (Directiveness), Motor (Manual Dexterity), and Receptive and Expressive Language*

Model 2	$\chi^2/df$	Comparative Fit Index	Normed Fit Index	Standardised Root Mean Square Residual	Root Mean Square Error of Approximation
Measurement model	0.163/2 = 0.082	1.000	.996	.010	.000 (90% CI: .000, .075)
Structural model	0.163/2 = 0.082	1.000	.996	.010	.000 (90% CI: .000, .075)

CI = confidence interval.

As can be seen in Figure 6.2, the significance of the pathways from parenting style (this time measured by Directiveness) to Manual Dexterity and from Manual Dexterity to language suggests that Manual Dexterity might mediate the relationship between parenting style and language.

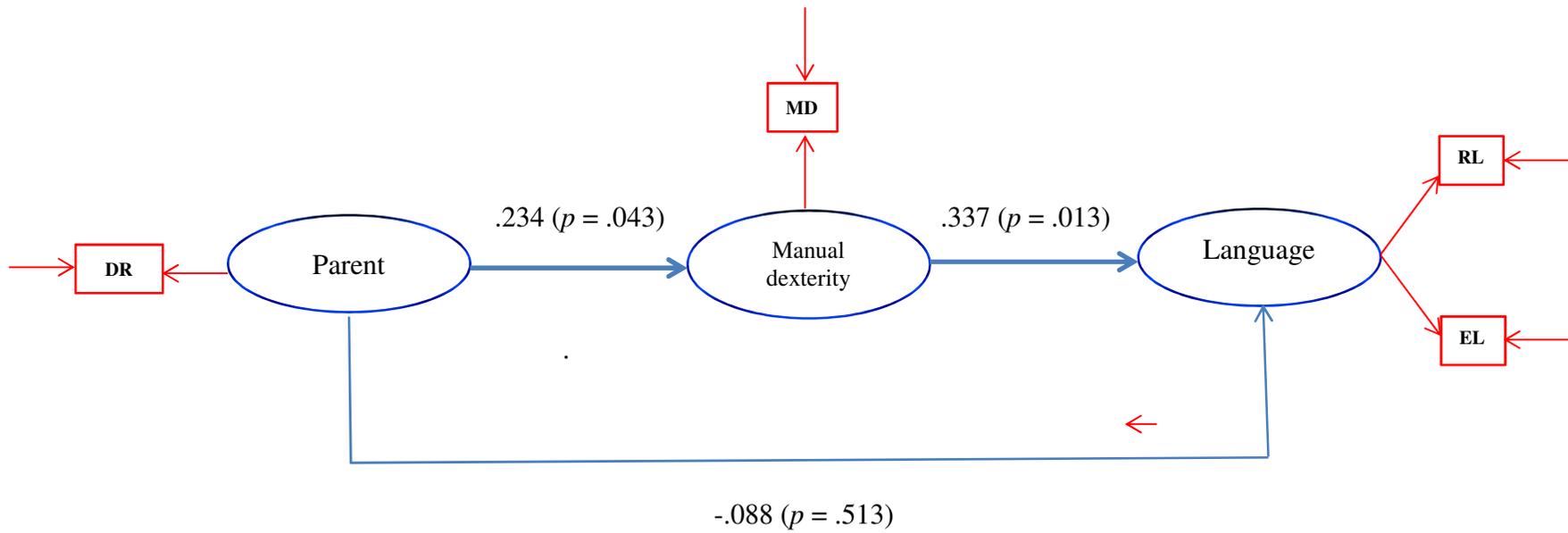


Figure 6.2. Model 2: Measurement model (in red) and structural model (in blue). DR = directiveness; MD = manual dexterity; RL = receptive language; EL = expressive language.

Before we can conclude that Manual Dexterity is a mediator, however, two conditions must be satisfied. Firstly we have to show that the *overall* indirect effect from parenting to language via Manual Dexterity is significant. The strength of the indirect effect is given by the product of its two component path coefficients; .274 multiplied by .337 equals .092, which is not significantly different to zero ( $z = 1.64$ ,  $p = .101$ ). Although the component pathways from parenting to Manual Dexterity and from Manual Dexterity to language are both significant, these effects are not strong enough to carry the effect of parenting through Manual Dexterity to language. In any case, there was no correlation between parenting and language to begin with ( $r = .016$ ,  $p = .910$ ), and therefore no relationship to mediate (see table 6.12).

Table 6.12

*Correlations between Latent Variables in Model 2*

	Parent	MD	Language
Parent	1.000		
MD	0.274 *	1.000	
Language	-0.009	0.316 **	1.000

*Notes:* Parent = Directiveness; MD = manual dexterity; Language = receptive and expressive language.

\*  $p < .05$  (two-tailed).

\*\*  $p < .01$  (two-tailed).

## 6.4 Discussion

The aim of the present study was to advance our understanding about the linkages between parenting behaviours, motor and language development. This is consistent with the dynamic systems theory that posits developmental outcomes in children can be influenced by the interaction between multiple sub-systems within the child, the demand of the task, and the environment (Lewis, 2000; Newell, 1986; Thelen et al., 1991). Past research has also demonstrated that motoric behaviours and interactions with the environment could influence the development of skills and experiences in children, which in turn, play a significant role in the emergence of

later language attainment (Iverson, 2010). With these assumptions, two mediation models were tested, after controlling for mother's age, ethnicity, and the child's verbal and non-verbal IQ in the present study.

#### **6.4.1 Correlations between latent variables.**

Model 1 revealed a strong relationship between latent variables (Parent as measured by Responsiveness, Affect and Achievement Oriented; MD as measured by Manual Dexterity; Language as measured by Receptive and Expressive Language). In particular, Parent was strongly correlated with Language ( $r = .668, p < .01$ ), as was the relationship between Parent and MD (.336). Although the correlations among the latent variables indicate a significant relationship between Manual Dexterity and Language, this was reduced to non-significance after controlling for Parent.

In Model 2, a modest relationship was found between the latent variables (Parent as measured by Directiveness; MD as measured by Manual Dexterity; Language as measured by Receptive and Expressive Language). In particular, Parent was correlated with MD (.312), as was MD and Language (.336), although the correlation between Parent and Language was non-significant (.016).

#### **6.4.2 Model 1: Responsiveness, Affect, and Achievement Orientation**

Model 1 indicated that the pathway from parenting behaviours (specifically Responsiveness, Affect, and Achievement Orientation) to language development (specifically Receptive and Expressive Language) was significant, as was the pathway from parenting behaviours to motor development (specifically Manual Dexterity). These findings are consistent with past research that parental responsiveness, affect, and achievement orientation have been positively associated with motor development (Chiarello et al., 2006; Chiarello & Palisano, 1998; Kim & Mahoney, 2004), and language development in typically and atypically developing children (Fewell, & Deutscher, 2002; Masur et al., 2005).

Past studies have demonstrated that parent responsiveness could facilitate their children's cooperation and engagement, and provide essential verbal input that is fundamental for language development (Landry et al., 2006; Masur et al., 2005). Recent research has also suggested that responsive parents tended to provide

appropriate materials and home environments to promote children's outcomes (Bradley & Corwyn, 2002). Furthermore, Kim and Mahoney (2004) suggest that the influence of maternal responsiveness on children's developmental outcomes is mediated by the amount of time children spend engaging in tasks or activities that support learning. The sample used in this thesis consisted of mothers mainly from higher income families (86%) and who had obtained a Bachelor degree or higher (87%). Thus it is plausible that mothers from higher income families and higher educational levels are more likely to have better resources, which in turn, provide greater opportunities to support their children's learning environment. This assumption is consistent with past research that shows responsive parents could have a significant impact on their children's motor development (Chiarello et al., 2006; Chiarello & Palisano, 1998; Kim & Mahoney, 2004) and language outcomes (Brady, Warren, & Sterling, 2009; Fewell, & Deutscher, 2002; Masur et al., 2005). In this instance, mothers who are responsive are more likely to recognise and respond to their children's verbal and non-verbal cues and needs. Therefore, when young children use motoric behaviours (e.g., pointing to a toy) to engage the attention of their parents during a social or play interaction, such interaction is more likely to be reciprocal, providing the opportunity to enhance parent-child interactions. This in turn, could influence the child's sensory inputs that may facilitate motor development (Knoblich & Flach, 2001; Mechsner, Kerzel, Knoblich, & Prinz, 2001; von Hofsten, 2004). This notion is supported by the dynamic systems theory that posits motoric actions such as walking, for example, require the child to continually coordinate their perceptual information and motor behaviour (Kamm et al., 1990; Thelen and Smith, 1994).

Theorists such as Bowlby (1969) postulate that when parents respond to their children's cues and needs appropriately, parent-child interaction would thrive, which in turn, would facilitate children's development. Past studies have revealed that children with affective parents are more likely to display positive emotionality such as acceptance and enjoyment during play time (Cassidy, 1994; Johnson, Cohen, Kasen, Smailes, & Brook, 2001). The reciprocity inherent in mutually shared positive affect between parents and their children is theorised to foster understanding of cause and effect in children, and their readiness for adult input and support,

which in turn, enhances their cognitive and social development (Ainsworth et al., 1978; Bornstein & Tamis-LeMonda, 1989).

Other research has also highlighted that high levels of positive affect are more likely to contribute to the child's willingness to embrace his or her parent's messages and values (Maccoby, 1984; Kochanska & Thompson, 1997). Thus when parents display greater levels of positive affect, this subsequently influences the child's use of emotional language and emotional understanding which then increases his or her internalisation. Past studies have also highlighted less positive affect maybe related to maternal depression and a perception of financial resource availability (Mistry, Biesanz, Taylor, Burchinal, & Cox, 2004). In the present study, mother's age, education levels and ethnicity were correlated with affective parenting. Higher education is related to greater opportunity of resources availability (Coleman & Karraker, 2004; Smetana, 2000), which could provide an optimal environment to facilitate children's language development. This is consistent with the existing literature that positive affect (emotional support) and verbal input could have significant impact on children's language outcomes (Tamis-LeMonda et al., 2001).

Similarly, affective parents who consistently provide appropriate and prompt reactions which match the child's developmental level are more likely to support motor development (Landry et al., 2001; Smith, Landry, & Swank, 2000). Past studies have demonstrated that positive affect exhibited by parents during parent-child interaction reinforces and maintains children's engagement in communicative exchanges, which in turn, may facilitate development of self-regulation (Bell & Ainsworth, 1972). Some researchers have pointed out that self-regulation could influence observational learning that foster acquisition of motor skills (Buchanan & Dean, 2010; Ferrari, 1996; Ste-Maire et al., 2012). For example, when affective parents display enjoyment, acceptance and positive verbal and non-verbal expressions in teaching a child to play a piano, such parent-child interactions would most likely encourage the child to closely observe his or her parents in order to learn and reproduce these motor movements. Thus parental affect may optimise children's learning of motor skills, but more importantly, affective parents could also facilitate children's acquisition of motor strategies such as sports training, competition or

rehabilitation (Clark & Ste-Marie, 2007; Cumming, Clark, Ste-Marie, McCullagh, & Hall, 2005; Rymal, Martini, & Ste-Marie, 2010; Ste-Marie et al., 2012).

Earlier studies have suggested that achievement orientation in an individual is moderated by a number of personality variables (Heckhausen & Schulz, 1995; McClelland et al., 1953; Sohn, 1984). Achievement-oriented individuals, for example, have a greater tendency to place value on competent performance and have a greater motivation to achieve high levels of skill with the given tasks. Studies have also demonstrated that achievement-orientated individuals positively relate to intrinsic motivation which facilitates autonomy and optimal challenge (Boggio & Pittman, 1992). This is consistent with past research that suggests achievement-oriented parents have higher levels of parental involvement (Epstein & Connors, 1995; Epstein & Dauber, 1991; Epstein & Lee, 1995; Hoover-Dempsey et al., 2001), parental monitoring (Clark, 1993; Hill & Taylor, 2004; Muller, 1995, 1998), and parental goals, values and aspirations (Astone & McLanahan, 1991; Crandall et al., 1964; Keeves, 1972; Ford, Wright, Grantham, & Harris, 1998; Prom-Jackson, Johnson, & Wallace, 1987; Pugh, 1976; Wigfield, 1993). Thus achievement-oriented parents are likely to be more involved with their children's outcomes such as school achievement. In turn, these children perceive their parents as being more autonomy-oriented and supportive. Children with achievement-oriented parents tend to identify their parents' values, actions and goals with their own achievement. Children may want to learn to read and write, for example, because "they want to understand better." Thus it is possible that achievement-oriented parents facilitate their children's motor development and language outcomes by being more involved and monitor their children's progress, which in turn, provides the child with the opportunity and motivation to master these skills.

#### **6.4.3 Model 2: Directiveness**

Model 2 indicated that parenting behaviours (specifically Directiveness) did not impact on language development (specifically Receptive and Expressive Language) through motor development (specifically Manual Dexterity), that is motor development did not mediate the relationship between parenting behaviours and language outcomes.

In contrast, the pathway from Directiveness to Manual Dexterity was significant, as was the pathway from motor to language development. These findings have reinforced past studies that parental directiveness is positively associated with motor development (Chiarello & Palisano, 1998). Similarly, the findings also supported the existing literature that motor development is correlated to children's language outcomes (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Oller et al., 1999; Viholainen et al., 2006; Vukovic et al., 2010; Wang et al., 2014). However, the results indicated that directive parenting behaviours appear to have no significant impact on their children's language outcomes, which is inconsistent with existing research (Akhtar et al., 1991; Barnes et al., 1982; McCathren, Yoder, & Warren, 1995; Murray & Hornbaker, 1997; Taylor, Donovan, Miles, & Leavitt, 2009).

A plausible explanation as to why the findings in this study differ from past research could be attributed to the limitation of the construct itself. In this study, displays of directiveness behaviours were measured by occurrences of directing or controlling the child's immediate behaviours and the parent's pace in matching the child during play session. Whilst assessing the frequency of specific parenting behaviours, rather than attitudes or beliefs, that could provide specific behavioural information (Tyano et al., 2010), recent research has demonstrated that parent's directive behaviours could be linked to the dimension of psychological control in children as young as six years (Morris et al., 2001). However, psychological control is not included in the MBRS-R. Furthermore, when intrusive and directive behaviours are moderated by parental warmth, for example, evidence has suggested that this type of parenting behaviour is positively associated with children's outcomes (Ispa et al., 2004; McLoyd & Smith, 2002). This suggests that research should also target different behaviours that parents might simultaneously exhibit. This assumption is consistent with past studies that have shown directiveness coupled with parental sensitivity to be a positive predictor of expressive and receptive language skills in young children (Hughes et al., 1999).

Maternal directiveness is one of the most studied aspects of parenting behaviours because it is a multifaceted and complex phenomenon that could have positive or negative implications for children's motor development. Children with parents who

show greater levels of directiveness appear to have poorer motor abilities (Cress et al., 2008; Marfo, 1992). In contrast, children with parents who use directive behaviours that have been incorporated as part of an early invention program, for example, showed greater degrees of motor ability (Chiarello et al., 2006). Furthermore, directive behaviours can be potentially positive when they are consistently provided at a pace that matches the child's developmental needs and levels (Cress et al., 2008).

In the present study, fine motor skill was significantly correlated with mother's age (mean age 37 years). Past research has shown that negative and intrusive/controlling behaviours are more prevalent in young mothers in comparison to older mothers (Berlin et al., 2002; Culp et al., 1988; Garner, Rennie, & Miner, 1996). Similarly, recent studies conducted by Lewin, Mitchell and Ronzio (2013) involving 11,000 mother-child dyads have demonstrated both adolescent mothers (aged < 19 years old) and emerging adult mothers (19 to 25 years old) reported greater occurrences of smacking and usage of time out with their children when compared to adult mothers (aged > 25 years old). From the developmental perspective, some researchers have highlighted that adolescents and emerging adults are facing greater challenges in establishing their own role of identity and their relationship to others at this developmental stage (Erickson, 1986). As the majority of participants in this thesis were older mothers, it is plausible that they have established their own identity and relationship to others, which in turn, could help them cope with the challenges of parenting. Therefore, it is plausible that during this stressful developmental period, adolescent mothers and emerging adult mothers find it more stressful in coping with the challenges of parenting. This assumption is consistent with the observation that older mothers used less negative and intrusive/controlling behaviours but directed and followed a pace that matched the child's needs and levels instead.

#### **6.4.4 Impact of control variables in parenting behaviours.**

In this study, the mother's age, education level, and ethnic group, and the child's verbal and non-verbal IQ were correlated with the different dimensions of parenting behaviours, including Responsiveness, Affect, and Achievement Orientation. In particular, maternal age was positively associated with Responsiveness and Affect.

This aligns with past research that suggests older mothers may show greater levels of parenting behaviours that are responsive and affective towards their child (Berlin et al., 2002; Bornstein et al., 2006; McAnarney, Lawrence, Ricciuti, Polley, & Szilagyi, 1986; McFadden & Tamis-LeMonda, 2013; Mahoney et al., 1998). A plausible explanation for this is that teen mothers may have limited knowledge of child development (Osofsky, Hann, & Pebbles, 1993; Roosa & Vaughn, 1983; Stevens, 1984). In addition, teen mothers may be less skilled users of language and indulge in play behaviour that is less likely to engage in language facilitation (Culp et al., 1988; Culp, Culp, Osofsky, & Osofsky, 1991; Keown, Woodward, & Field, 2001).

Maternal education levels were also positively correlated with parents who are responsive, affective and achievement-oriented, which is consistent with existing literature (Eshbaugh et al., 2011, Tamis-LeMonda, Briggs, McClowry, & Snow, 2009). Furthermore, some researchers have highlighted that mothers' education is a strong predictor of children's cognitive development (Chase-Lansdale, Brooks-Gunn, & Zamsky, 1994). In the present study, the majority of mothers had obtained a degree or higher (87%), thus this may be of benefit to their children's cognitive development. Higher education could have attributed to the mothers (and families) available resources, which in turn, provide a rich environment (books and educational toys) for the child. This aligns with past research that reveals children with teen mothers are at higher risk of being cognitively disadvantaged, particularly because they have limited opportunities to be exposed to rich language surroundings (Brooks-Gunn & Furstenberg, 1986; Culp, Culp, Blankemeyer, & Passmark, 1998; Jaffe, Caspi, Moffitt, Belsky, & Silva, 2001). Mothers' ethnicity was also correlated with Responsiveness, Affect and Achievement Orientation, indicating that positive parenting behaviours were different between Australian mothers and non-Australian mothers, which are consistent with past studies (Brooks-Gunn & Markman, 2005; Davis et al., 2001; Fuligni & Brooks-Gunn, 2013; Kelley et al., 1992; Kohlmann, Schumacher, & Streit, 1988; Russell et al., 2003; McLoyd, 1990; Wilson et al., 1995).

#### **6.4.5 Limitations**

Although the results supported the notion that parent-child interactions could play a significant role in children's outcomes, several limitations have been

identified and warranted further discussion. First, this study consisted of a small sample size of self-selected mothers who mostly identified themselves with higher family income and higher education levels. In addition, the present study focused on a normative sample size of typically developing children and their mothers, resulting in lack of generalisability to other populations. Moreover, “motor development” was operationalised with just one of the three MABC-2 motor skill subscales, namely, Manual Dexterity. Tasks for Manual Dexterity involve activities such as posting coins into a box, threading beads and drawing bicycle trails, and are therefore limited to fine motor skills. Past research has shown that there can be a different performance pattern in gross motor (e.g., heel to toe walking) and fine motor (e.g., putting beads in a box) functions, particularly in children with developmental language impairments and developmental coordination disorders (Hill, 1998; Piek & Dyck, 2004; Wisdom et al., 2006).

Although Aiming and Catching and Balance tests were assessed in the present study, they were dropped from the the structural model analyses because they did not correlate with parenting and language measures. Thus replication is warranted to further investigate the relationship between parenting behaviours, and a broader range of motor functions and language outcomes, but more importantly, this could advance our knowledge of the underlying neural processes, particularly the relationship between the articulatory control system and phonological store in the co-occurrence of motor and language functions. In addition, although past studies have shown that motor functioning is closely related to growth and language development, particularly in children with language disorders and motor impairments (Adi-Japha et al., 2011; Hill, 2001; Jäncke et al., 2007; Rechetnikov & Maitra, 2009; Ullman & Pierpont, 2005; Webster et al., 2005; Wisdom et al., 2006), the interdependency of these key factors is not well understood.

Moreover, careful interpretation of the results presented in this study is warranted because they do not imply a cause-and-effect relationship. The most that can be concluded from the current structural equation modelling analyses is that the hypothetical causal pathways do a good job accounting for the correlational data. In addition, the remaining 62 of the 87 videotapes were coded by the author, in which experimenter bias might have occurred. Future research could involve only trained

independent raters to code all the videotapes to eliminate the susceptibility of experimenter biases. However, it is important to note that the interrater reliability of this study was rated as excellent.

#### **6.4.6 Conclusion**

Overall, the results of the current study support two of the hypotheses, namely, that parenting behaviours are significant predictors of children's motor development, and language development. In particular, Models 1 and 2 showed that there was a significant relationship between parenting behaviours (Responsiveness, Affect, Achievement Orientation, and Directiveness) and motor development (Manual Dexterity). These findings added to the existing literature that parenting behaviours have a significant impact on children's motor development (Chiarello et al., 2006; Chiarello & Palisano, 1998; Kim & Mahoney, 2004). This crucial finding is consistent with the dynamic systems theory that posits interaction between multiple sub-systems within the child, the demand of the task, and the environment could be accounted for children's developmental outcomes (Lewis, 2000; Newell, 1986; Thelen et al., 1991). Model 1 also showed that parents who are responsive, affective and achievement-oriented were positively associated with language outcomes in young children, which is consistent with the existing literature (Fewell & Deutscher, 2002; Masur et al., 2005). The overall findings in the present study have added to the existing literature that different dimensions of parenting behaviours could have significant influence on children's motor and language development.

However, the lack of mediation (and uncorrelated latent constructs between Directiveness and language) is consistent with different underlying factors or mechanisms accounting for the relationship between directiveness and manual dexterity on the one hand, and manual dexterity and language on the other. Past studies have demonstrated that parental directiveness, for example, could be linked to the dimension of psychological control (Carlson & Harwood, 2003; Guzell, & Vernon-Feagans, 2004; Ispa et al., 2004; Jackson-Newsom, Buchanan, & McDonald, 2008; Morris et al., 2001).

A possible explanation is shared neurological systems or resources that could have accounted for the fine motor and language relationship. This is consistent with

the assumption that speech is a form of fine motor skill and the development of the speech system may be linked to a phonological loop function, and therefore language. Furthermore, environmental factors such as parenting behaviour may explain the link between directiveness and fine motor abilities. This is consistent with the findings of the current study that different qualities of parenting behaviours could play an important role in children's outcomes, particularly in children with motor and language difficulties. In this instance, maternal and child interactive behaviours could be incorporated during early assessment and intervention to support children's outcomes. For children with movement difficulties, for example, learning strategies that focus on task modification such as visual reasoning by using pictures or symbols rather than a hand written task, may be useful to encourage the child's competency in the classroom.

More importantly, the observational method has provided valuable and reliable insights into the dynamics and complexity of maternal and child interactive behaviours in relation to children's outcomes. The findings in Studies 1 (Chapter 5) and 2 (Chapter 6) suggest that the use of different parenting measures, namely, parent-reported assessment and the observation method, may have a significant influence in the results obtained. Thus, the next chapter presents a systematic comparison of these two different methodologies that have been commonly used in parenting literature.

## Chapter 7

### Study 3

#### 7.1 Overview

Researchers and clinicians have used different methodologies to gain insight into parenting behaviours. Two principal procedures have been widely used to assess parenting, namely parent-report questionnaires or assessments, and observational approaches that are direct and objective (e.g., standardised procedures including selection of times, settings, tasks and interrater agreement). These methods were designed to focus on assessment and/or intervention. Assessing the relationship between parenting and developmental outcomes is important both in clinical and research settings because it provides preliminary support for a focus on parenting behaviours that could optimise children's functioning.

Whilst research into parenting behaviours has relied primarily on observational methods to assess and determine parenting behaviours (Harvey et al., 2001), parent-report assessments are cost-effective and may be needed when observation is impractical. However, some studies (e.g., Baker, Blacher, Crnic, & Edelbrock, 2002; Baker et al., 2003; Deimann & Kastner-Koller, 2011; Willinger & Eisenwort, 2005; Willinger et al., 2011) have revealed that parents have a tendency toward a general over-estimation of their child's developmental functioning such as in vocabulary, gross motor skills and cognitive abilities, specifically mothers with atypically developing children with developmental delays. Therefore, it is plausible that mothers with atypically developing children in particular, might over-estimate their parenting abilities when asked to complete a self-reported questionnaire. It is possible to use both parent-reported assessments and observational methods to measure parent-child interaction, although that can be impractical and cost-ineffective in terms of time and resources. However, some researchers have pointed out that using a multi-method approach could provide the most reliable and accurate assessment of parenting behaviours (Harvey et al., 2001; Lovejoy et al., 1999; O'Connor, 2002; Tyano et al., 2010).

Furthermore, different terminology has been used to describe similar constructs. Therefore, it is no surprise that there is a lack of agreement amongst researchers with

regard to combining meaningful parenting behaviours as measured in parent-report assessments and observational methods to use as a comprehensive and valid assessment of parenting (O'Connor, 2002). More importantly, it has not been possible to compare different constructs of parenting behaviours between different research methods due to the inconsistencies in terminology, definitions, and measurements of parenting behaviours in the existing literature. For example, “maternal sensitivity”, “maternal responsiveness” and “sensitive mothering” have been used interchangeably in the parenting literature to describe parental responsiveness (Shin, Park, Ryu & Seomun, 2008).

Although it is beyond the scope of present study to examine the broad range of constructs that have been used in the existing parenting research, the present study aimed to investigate whether constructs between two different parenting measures could have tapped into the same dimensions of parenting. This assumption is consistent with past studies that have shown parenting behaviour is not a uni-dimensional construct but instead comprises multiple behaviours, including responsiveness (Ainsworth et al., 1978; Bornstein, Tamis-LeMonda, Hahn, & Hayners, 2008); warmth (Eshbaugh et al., 2011; Masur et al., 2005; Smith, Landry, & Swank, 2006), positive and negative affect (Belsky & Jaffee, 2006; Karazsia & Wildman, 2009; Waters, Wippman, & Stroufe, 1979), levels of control or intrusiveness (Grolnick, 2003; Ispa et al., 2004), and didactic or dual behaviours such as language and cognitive stimulation (O'Connell & Bretherton, 1984; Tamis-LeMonda, Uzgiris, & Bornstein, 2002).

Thus Study 3 aimed to evaluate the relationship between parent-reported assessment (namely, PBDQ) and an observational method (namely, MBRS-R) with mothers and their typically developing children aged from four to six years. This could provide information about the convergent validity of the measures. It was hypothesised that the set of variables from the PBDQ (Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline and Democratic Discipline subscales), would correlate with another set of variables from the MBRS-R (Responsiveness, Affect, Achievement Orientation and Directiveness), as presented in Figure 7.1.

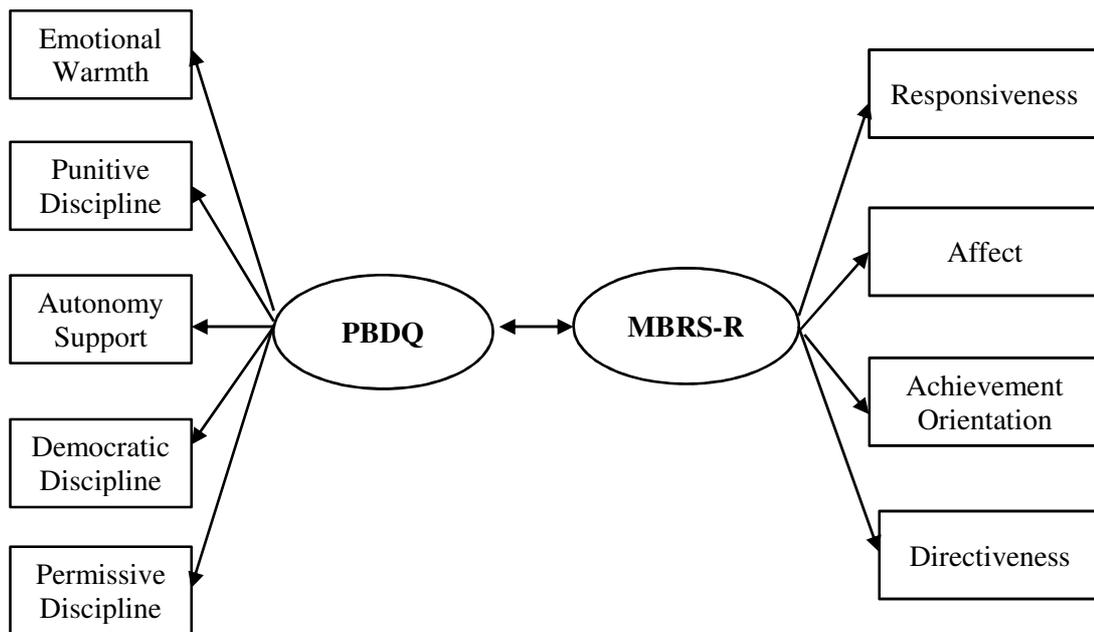


Figure 7.1. Proposed canonical correlation analyses between the PBDQ and the MBRS-R variables.

## 7.2 Method

### 7.2.1 Participants, measures and procedure.

Participants consisted of 84 mother-child dyads drawn from Study 2. All demographic information for the participants was described in Chapter 6. Measures included PBDQ (see Appendix F) and MBRS-R (see Appendix L). The procedures used in this study were described in Chapters 5 and 6.

### 7.2.2 Statistical analyses.

Means, standard deviations, and ranges were computed for the PBDQ (as measured by Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline and Democratic Discipline subscales) measures, and the MBRS-R (as measured by Responsiveness, Affect, Achievement Orientation and Directiveness subscales) measures. Pearson's correlation coefficients were computed between the two sets of measures. This analysis provided information on the degree to which pairs of measures converged on a common parenting construct. Pearson's correlation was also computed between the PBDQ and the MBRS-R total scores. Lastly, a canonical correlation analysis, which is a multivariate statistical procedure

for analysing the linear interrelationships between two set of variables, was conducted. Unlike Pearson, which analyses the *bivariate* relationships between PBDQ and MBRS measures, canonical correlation analyses the *multivariate* relationships between the two sets of measures. Therefore, canonical correlation accounts for the intercorrelations among the measures *within* each of the two sets.

### **7.3 Results**

#### **7.3.1 Descriptive statistics.**

The means, standard deviations, and ranges for the two sets of variables (PBDQ and MBRS-R) are presented in Table 7.1.

Table 7.1

*Means, Standard Deviations and Ranges for the Two Sets of Variables (N = 84)*

Variables	Mean	SD	Range
<b>PBDQ</b>			
Emotional Warmth <sup>a</sup>	5.53	0.32	4.67 – 6.00
Punitive Discipline <sup>a ^</sup>	4.85	0.47	3.67 – 6.00
Autonomy Support <sup>a</sup>	5.05	0.51	3.00 – 6.00
Permissive Discipline <sup>a ^</sup>	5.31	0.51	3.00 – 6.00
Democratic Discipline <sup>a</sup>	4.27	0.51	3.00 – 5.33
<b>MBRS-R</b>			
Responsiveness <sup>b</sup>	4.23	0.69	2.33 – 5.00
Affect <sup>b</sup>	3.75	0.71	2.00 – 4.80
Achievement Orientation <sup>b</sup>	3.49	0.76	1.50 – 5.00
Directiveness <sup>b</sup>	3.02	0.44	2.00 – 4.50

*Notes:* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MBRS-R = Maternal Behavior Rating Scale Revised.

<sup>a b</sup> Total score is calculated by summing the means of each subscale.

<sup>^</sup> Reverse scored.

### **7.3.2 Assumption testing for canonical correlation.**

Canonical correlation assumes that pairs of variables in the analysis are linearly related. Scatterplots of the bivariate relationships were examined. The Nine measures generated 45 bivariate scatterplots. A random selection of 20% ( $n = 9$ ) of the 45 scatterplots showed no obvious curvilinear trends (see Appendix O); linearity was therefore assumed. Canonical correlation also assumes that pairs of variables are homoscedastic. Homoscedasticity between a pair of measures can be tested by conducting a regression analysis with one measure as the dependent variable and the other as the predictor, and then examining the plot of the standardised studentised residuals against the standardised predicted values. Heteroscedasticity is indicated when the points fan out from left-to-right or from right-to-left. A random selection of

20% of the 45 plots showed no obvious fanning out (see Appendix O), suggesting that the assumption of homoscedasticity had not been violated.

Canonical correlation analysis also assumes that the variables in the analysis are normally distributed. As suggested by Field (2005), statistics of skewness and kurtosis were converted to z-scores by dividing the skewness and kurtosis values by their respective standard errors (see Table 7.2). Field (2005) recommended a cut-off z-score value of 2.58 for a sample size less than 200. Results indicated that Autonomy Support, Permissive Discipline, Responsiveness, and Directiveness exceeded an absolute value of 2.58 for skewness, kurtosis or both. Canonical correlation further assumes multivariate normality. Violations of univariate normality tend to imply violations of multivariate normality, which was the case in the present study where the chi-square test for multivariate non-normality was significant ( $\chi^2 = 13.54, p = .001$ ).

Table 7.2

*Descriptive Statistics for Skewness and Kurtosis for the Key Variables (N = 84)*

	Skewness		Kurtosis	
	Raw Score	z-score	Raw Score	z-score
PBDQ emotional warmth <sup>a</sup>	-0.39	-1.48	-0.69	-1.33
PBDQ punitive discipline <sup>a ^</sup>	-0.24	-0.92	0.09	0.17
PBDQ autonomy support <sup>a</sup>	-1.52	-5.79 <sup>c</sup>	5.01	9.63 <sup>c</sup>
PBDQ permissive discipline <sup>a ^</sup>	-0.78	-2.97 <sup>c</sup>	0.75	1.44
PBDQ democratic discipline <sup>a</sup>	-0.08	-0.30	-0.45	-0.86
MBRS-R responsiveness <sup>b</sup>	-1.08	-4.09 <sup>e</sup>	0.76	1.47
MBRS-R affect <sup>b</sup>	-0.44	-1.67	-0.87	-1.68
MBRS-R achievement orientation <sup>b</sup>	-0.38	-1.46	-0.10	-0.20
MBRS-R directiveness <sup>b</sup>	0.47	1.77	1.48	2.85 <sup>c</sup>

*Notes:* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MABC-2 = Movement Assessment Battery for Children-2; CELF PRE-2 = Clinical Evaluation Language Fundamentals Preschool-2.

<sup>a b</sup> Total score is calculated by summing the means of each subscale.

<sup>c</sup> z-score exceeded an absolute value of 2.58.

<sup>^</sup> Reverse scored.

The Pearson correlations (which assume normality) were compared to the Spearman correlations (which do not assume normality) to determine the impact of the normality violations reported previously. The pattern of significant correlations was comparable across the two correlation matrices (see Appendix O). It was therefore concluded that the departures from normality shown by some of the measures had little impact on the reliability of the Pearson correlation. The more versatile Pearson correlation was therefore used for the canonical correlation analysis.

### **7.3.3 Pearson's correlation.**

Pearson's correlations were computed between PBDQ subscales (Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline and Democratic Discipline) and the MBRS-R subscales (Responsiveness, Affect, Achievement Orientation and Directiveness). Two-tailed tests were used to test the significance of the correlations. Table 7.3 presents the correlation coefficients. The results showed that the Democratic Discipline subscale was weakly correlated with Achievement Oriented ( $r = .219, p = .045$ ), and Punitive Discipline was weakly correlated with Directiveness ( $r = -.302, p = .005$ ). As Punitive Discipline was reverse scored, the negative correlation between this measure and Directiveness indicates that higher levels of Punitive Discipline are associated with higher levels of Directiveness.

Table 7.3

*Pearson's Correlation Matrix for the Key Variables (N = 84)*

	PBDQ Emotional Warmth <sup>a</sup>	PBDQ Punitive Discipline <sup>a</sup>	PBDQ Autonomy Support <sup>a</sup>	PBDQ Permissive Discipline <sup>a</sup>	PBDQ Democratic Discipline <sup>a</sup>
MBRS-R Responsiveness <sup>a</sup>	-.051	.020	-.006	.086	.153
MBRS-R Affect <sup>a</sup>	-.010	.144	.009	.083	.193
MBRS-R Achievement Orientation <sup>a</sup>	-.090	-.011	-.030	.030	.219 <sup>*</sup>
MBRS-R Directiveness <sup>a</sup>	.010	-.302 <sup>**</sup>	-.073	-.015	-.111

*Note.* PBDQ = Parenting Behaviours and Dimensions Questionnaire; MBRS-R = Maternal Behavior Rating Scale Revised.

<sup>a</sup> Total score is calculated by summing the means of each subscale.

<sup>\*</sup>  $p < .05$  (two-tailed).

<sup>\*\*</sup>  $p < .01$  (two-tailed).

In addition, the relationship between PBDQ total scores (i.e., the sum of the mean PBDQ subscale scores;  $M = 25.02$ ,  $SD = 1.50$ ), and MBRS-R total scores (the sum of the mean MRBS-R subscale scores;  $M = 14.49$ ,  $SD = 2.03$ ) was also examined. The results showed that the correlation between the two total scores was not statistically significant ( $r = .059$ ,  $p = .596$ ).

#### **7.3.4 Canonical correlation.**

It was noted previously that the assumptions of multicollinearity and homoscedasticity were met. Although the assumptions of univariate outliers, multivariate outliers and multivariate normality across the nine measures were violated, transformation of data was not employed. The analysis yielded four canonical correlations or functions (equivalent to the number of measures in the smaller set) with squared canonical correlations ( $R^2$ ) of .154, .067, .012 and .007; each function suggests a way which the two sets of variables might be related. The initial test of independence between the two sets of variables, however, was non-significant (Wilks's  $\lambda = .773$ ,  $F(20\ 249.70) = 1.01$ ,  $p = .456$ ) indicating that the two sets of variables were not related. Further examination of the canonical functions was therefore unwarranted.

#### **7.4 Discussion**

The aim of the present study was to examine the convergent validity of the PBDQ (Reid et al., 2012) and MBRS-R (Mahoney, 2008). The results of this study showed that there was a non-significant association between the full scales of PBDQ and MBRS-R, indicating that there was no significant relationship between the two measures. However, several PBDQ subscales and MBRS-R subscales were correlated. There was a correlation between Punitive Discipline and Directiveness subscales, and Democratic Discipline subscale was moderately correlated with Achievement Orientation subscale. This is consistent with past research that demonstrates constructs between the two measures (self-reported assessment and observational method) are moderately associated, indicating that parenting behaviours could be interrelated (Hawes & Dadds, 2006). This assumption also aligns with past research suggesting that parenting behaviour is not a static, uni-dimensional construct, but instead is made up of multiple dimensions of behaviours (Caron et al., 2006; McFadden & Tamis-LeMonda, 2013; Reid, 2012; Skinner et al.,

2005). In particular, the parenting dimensions from PBDQ did not reliably predict parenting dimensions as measured by the MBRs.

In the present study, higher scores on the Punitive Discipline subscale indicate greater degrees of harsh, mood-dependent and psychological controlling strategies, whereas, higher scores on the Directiveness subscale indicate higher levels of parent requests, commands, hints or attempts to direct and or to control the child's immediate behaviour, attention or action. Past research has revealed that parents who used the Punitive Discipline strategy often displayed behaviours that are restrictive, intrusive and power assertive of parental authority (Skinner et al., 2005). Such authoritarian parenting behaviour was also described by some researchers as psychological control. In parenting literature, the terminology of directiveness has been used interchangeably with "parental control strategies" (Crockenberg & Litman, 1990; Kochanska & Aksan, 1995; Putnam, Spritz, & Stifter, 2002). Parents who are directive or controlling often displayed higher degrees of instruction which permit only limited time for the child to process information related to the task or what is required from him or her. Thus the less directive or controlling are the parents when communicating with their children, the more likely is the child's autonomy, thus promoting and facilitating development of self-regulation and motivation, including a sense of control, persistency and perceived competence (Gauvain, Fagot, Leve, & Kavanagh, 2002; Grolnick, Frodi, & Bridges, 1984; Grolnick & Ryan, 1989; Grolnick et al., 1991; Neitzel & Stright, 2003; Pratt, Kerig, Cowan, & Cowan, 1988; Cowan & Cowan, 2002; Stright, Neitzel, Sears, & Hoke-Sinex, 2001).

Consistent with the self-determination theory proposed by Deci and Ryan (1985, 2000), psychological control and autonomy support have opposite influences on children's outcomes, in which relatedness, competence and autonomy are basic psychological needs that promote internalisation and intrinsic motivation in young children. Consequently, it is possible that the association between the Punitive Discipline and Directiveness subscales could be part of the psychological control dimension, including criticism, hostility, aggression, harshness, ignoring, and neglect (Barber, Xia, Olsen, McNeely, & Bose, 2012; Silk et al., 2003; Walling, Mills, & Freeman, 2007). This assumption is consistent with the existing literature that

suggests the dimension of autonomy support and parental control is a key variable in Punitive Discipline and Directiveness (Gurland & Grolnick, 2005).

The results also showed that there was an association between Democratic Discipline, and the subscale of Achievement Orientation. Higher scores on the Democratic Discipline subscale suggest parents tended to use explanations and inductive reasoning, and that interactions between parents and their children are bi-directional in order to establish mutually acceptable behaviours and actions. Higher scores on the Achievement Orientation subscale suggest parents often displayed different approaches or stimulations through play, instruction, training or sensory stimulation to encourage and support their children in the development of sensorimotor skills and cognition. In the PBDQ, Reid (2012) hypothesizes that Emotional Warmth and Democratic Discipline subscales are consistent with descriptions of Baumrind's (1966, 1967, 1971) authoritative parenting.

Furthermore, the subscale of Achievement Orientation describes behaviours typically displayed by authoritative parents involving warm, stable, rational, non-intrusive, appropriate, and affectionate qualities, when interacting with their children (Saetermoe et al., 1991; Taylor et al., 2004). Therefore, it is plausible that from the face validity, which is the extent a measure is subjectively viewed as covering the key concept it is supposed to measure, the results presented suggest that Democratic Discipline and Achievement Orientation subscales may be part of authoritative parenting. As the present study is correlative in nature, this does not imply causality. Thus, future research is needed to examine the close relationship between these constructs. More importantly, the findings suggest that the central constructs of parenting behaviours could be better represented using multiple dimensions of parenting behaviours (Caron et al., 2006; Reid, 2012; Skinner et al., 2005). This also highlighted the importance of providing more accurate and meaningful descriptions of parenting behaviours.

Interestingly, the Emotional Warmth, Autonomy Support, Permissive Discipline, Responsiveness, and Affect subscales were not related when examined at the subscale level between PBDQ and MBRS-R. This is inconsistent with the existing literature that suggests these constructs are similar (Caron et al., 2006; Reid, 2012; Skinner et al., 2005). Consequently, it is possible that there have been discrepancies

between the behaviours measured in self-reported assessments and the observational method that could be attributed to both method effects and situational effects (Lovejoy et al., 1999). Past research has shown that mothers with atypically developing children, for example, might over-estimate the child's developmental functioning such as language, motor and cognitive skills (Baker et al., 2002, 2003; Deimann & Kastner-Koller, 2011; Willinger & Eisenwort, 2005; Willinger et al., 2011). In this research, the MBRS-R, not only observes the parent behaviours but also the reaction of the child. In addition, the small sample size ( $N = 84$ ) of this study is likely limiting the statistical power to identify a significant association between the PBDQ and MBRS-R.

It is important to note that the present study was descriptive and exploratory in nature. Our hypothesis for a significant relationship between the two parenting measures, namely, PBDQ and MBRS-R, was not supported. Although when examined at the subscale level, the presented results supported the existing studies, and whilst different terminologies are used to describe different parenting behaviours, they appear to describe behaviours that are parts of a similar dimension of parenting behaviours. More specifically, the results suggest that the Punitive Discipline and Directiveness subscales may be part of the psychological control dimension. Similarly, different terminologies including Democratic Discipline and Achievement Orientation seem to be consistent with Baumrind's (1966, 1967, 1971) authoritative parenting.

Some researchers have pointed out that measures might differ in the content of their criteria, which is commonly associated with different measures developed from different theoretical perspectives (Geuze, Jongmans, Schoemaker, & Smits-Engelsman, 2001; Henderson & Barnett, 1998). However, the development of the PBDQ and MBRS-R relied on similar parenting literature. Consequently, although it is speculative in nature, it is plausible that the parenting construct in both measures is part of the same dimension of parenting behaviour. Replication is needed so that consistent terminology could be used by researchers and clinicians when assessing parenting behaviours for assessment and planning of early intervention. However, in the present study, transformation of data was not employed although the assumptions of univariate outliers, multivariate outliers and multivariate normality across the nine

measures were not met. Thus careful interpretation of the results is necessary. Future research is warranted to establish a clear and definitive dimension of parenting behaviours so that accurate conclusions could be drawn on the relationship between parenting behaviours and children's developmental outcomes.

## **Chapter 8**

### **General Discussion and Conclusions**

For the past 60 years, mothers have been one of the most important informants within the parenting literature in determining the influence of parenting behaviours on children's developmental outcomes. Both mother-reported assessments (Locke & Prinz, 2002) and observational approaches (Forehand & McMahon, 1981; Patterson, 1982) are commonly used for assessing parenting behaviours. Although different dimensions of parenting behaviours have been identified that could facilitate or hinder children's motor and language development, limited research has focused on a systematic effort to measure and compare parenting behaviours using different approaches. In addition, very few studies have been carried out to examine whether different outcomes are found when using different parenting measures. More importantly, past literature investigating the relationship between parenting and developmental outcomes has strongly focused on infancy. Thus, this thesis consists of three studies in which a normative sample of preschool and early school children aged four to six years and their mothers was employed. Studies 1 and 2 examined the linkages between parenting behaviours, and motor and language development by using two different parenting measures, namely, the PBDQ, and MBRS-R. Study 3 examined the convergent validity between the constructs of the PBDQ and MBRS-R.

This study aimed to examine three different key areas. First, the present study aimed to determine whether our cross-sectional correlational data are consistent with a causal model in which parenting behaviours impact motor and language development in typically developing children aged four to six years. The second aim was to differentiate various dimensions of parenting behaviours including Responsiveness, Warmth, Affect, Achievement Orientation, Directiveness, and disciplinary strategies (namely, Punitive Discipline, Democracy Discipline, Autonomy Support, and Permissive Discipline) that have been associated with children's motor and language development. Third, this study aimed to extend our knowledge by systematically comparing and contrasting different parenting measurements (parent-reported questionnaires, namely, PBDQ, and naturalistic observation, namely, MBRS-R).

## 8.1 The Mediation Model

Taken together, Studies 1 and 2 did not support the prediction that motor development had a mediation effect on the relationship between parenting behaviour and language development in young children. Although the component pathways from parenting to motor, and from motor to language were both significant in Model 2 of Study 2, this was not a mediation model because there was no significant relationship between parenting and language outcomes. These results indicated that directive parenting behaviours appear to have no significant impact on their children's language outcomes, a finding that was not consistent with past studies that suggest parental directive could support children's language outcomes (Akhtar et al., 1991; Barnes et al., 1982; McCathren et al., 1995; Murray & Hornbaker, 1997; Taylor et al., 2008).

Past research has shown that when directive behaviours are moderated by parental warmth, this type of parenting behaviour is positively associated with children's outcomes (Grusec, Rudy, & Martini, 1997; Ispa et al., 2004; McLoyd & Smith, 2002; Spieker, Larson, Lewis, Keller, & Gilchrist, 1999). Similarly, when directive behaviour is coupled with parental responsiveness, for example, this type of parenting behaviour becomes a positive predictor of expressive and receptive language skills in toddlers aged from 20 to 36 months (Hughes et al., 1999).

Other studies have demonstrated that parental directiveness could be linked to the dimension of psychological control (Carlson & Harwood, 2003; Ispa et al., 2004; Jackson-Newsom et al., 2008; Morris et al., 2001), which was not investigated in the present study. Furthermore, some researchers have highlighted that the relationship between parental directiveness and children's outcomes may decrease over time and differ between ethnic groups (Berlin et al., 2009; Carlson & Harwood, 2003; Ispa et al., 2004; Jackson-Newsom et al., 2008).

Early researchers have highlighted that parents using directive behaviour that focuses on what the child is attending to, such as objects, activities or people, could facilitate joint attention, which in turn, promotes children's vocabulary development (Akhtar et al., 1991; Pine, 1992). Other researchers have highlighted that directiveness has a unique strength that could support developmental outcomes when

the parent-child interactive behaviour is child-centred instead of parent-centred (Brody & Flor, 1998; Grusec et al., 1997; McLoyd & Smith, 2002). Although the present study did not support the hypothesised mediation relationship between parenting, motor and language development, further research is required to advance our knowledge of the complex phenomenon of parenting, particularly parental directiveness.

## **8.2 Parenting Behaviours and Motor Development**

Study 1 revealed that Emotional Warmth was negatively correlated with fine motor skills. This is consistent with past studies which found parental warmth to have the opposite effect on children's developmental outcomes (Pridham et al., 2002; Treyvaud et al., 2009). Although the studies conducted by Pridham et al. and Treyvaud et al. used an observational approach, a low agreement between raters and limitations associated with the parenting construct used were found in both studies. In the current study, the negative correlation between Emotional Warmth and fine motor skills may be associated with measurement artefact including skewed and a narrow range of scores for Emotional Warmth.

Study 2 suggested that parenting behaviours, namely, Responsiveness, Affect, Achievement Orientation, and Directiveness were associated with fine motor skills. This supports the findings of the existing literature that reveal parents could have a significant impact on children's motor development (Chiarello et al., 2006; Chiarello & Palisano, 1998; Kim & Mahoney, 2004). Past studies have demonstrated that modification of parent-child interactive behaviours (e.g., responsiveness) in early intervention has positively accounted for children's developmental outcomes such as motor, cognition, language, adaptive behaviour, and social-emotional development (Mahoney et al., 1998). Research has also suggested that when parents exhibit positive affect, this could lead to positive parent-child interactions that may facilitate children's self-regulation development. Some researchers have suggested that self-regulation could influence observational learning that supports acquisition of motor skills (Buchanan & Dean, 2010; Ferrari, 1996; Ste-Maire et al., 2012). Moreover, achievement-oriented parents are more likely to facilitate children's motor outcomes by being more involved with their children's developmental progress (Epstein & Connors, 1995; Epstein & Dauber, 1991; Epstein & Lee, 1995; Hoover-Dempsey et

al., 2001), which in turn, provides the child with the opportunity and motivation to master their motor skills. Interestingly, the findings in the present study also revealed that parental directiveness was a positive predictor of children's motor development. This crucial finding suggests that directiveness may have a unique strength that can be used to optimise children's motor outcomes.

Thus, a practical implication of the findings from this study is to utilise observation to evaluate and provide practical parent training intervention for children with motor disorders. For example, in a parent-child interaction observation study conducted by Chiarello et al. (2006), atypically developing children who are experiencing motor delay showed greater degrees of motor attainment when parents are taught to be more responsive, affective, and achievement oriented when playing with their children. Such observation could provide the opportunity for therapists to assist parents to understand the crucial parenting role that may support their children's motor development. For example, parental responsiveness and affect could foster children's fine motor skills through joint attention and engagement by using adaptive play equipments such as Play-Doh or Lego. Furthermore, parents could also support children's motor development by matching the pace of their children during play session. Parental directiveness could also be incorporated as part of intervention to support children's development of a sense of competency or mastery.

The findings of the current study also suggested there were differences in the results obtained when two different approaches were used to measure parenting behaviours. In particular, stronger effects were found in Study 2 (.336) as compared to Study 1 (-.191), suggesting that assessing parent-child interaction through observation is a stronger predictor of children's outcomes as compared to self-report assessment (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Hill, Maskowitz, Danis, & Wakschlag, 2008; Kochanska, Kuczynski, Radke-Yarrow, 1989; Smith, 2011; Zaslow et al., 2006). This supports the findings of past studies, suggesting that the study of parent-child interaction may be particularly informative because it captures the complexity of parenting behaviours that could have a direct impact on children's outcomes.

The study of parent-child interaction not only measures specific sets of behaviours, it is also carried out under standardised procedures such as carefully

selecting times, settings, tasks and established interrater agreement. The current findings also emphasise that observation may be an invaluable tool for examining the relationship between parenting behaviours and children's outcomes. More importantly, using the observational approach, distinctive parenting behaviours can be systematically observed which may provide clinically important information when planning and evaluating interventions, such as for children with motor disorders. Such information could be used for assessment and in development of early intervention programs that incorporate targeted behaviours to enhance children's motor development. For example, by watching the videotape between parent and child interactive behaviours, therapists could work together with parents to evaluate and expand the existing patterns of parent-child interactions that could support the child's motor development.

### **8.3 Parenting Behaviours and Language Development**

Interestingly, Study 2 (Model 1) showed that when parenting behaviours were measured using the observational approach, there was a significant strong effect (.632) between parenting behaviours, (namely, Responsiveness, Affect, and Achievement Orientation), and children's language development. This relationship was not mediated by motor development, suggesting that parenting behaviours could have a more direct impact on language learning experiences of the child and so facilitate overall language outcomes. Furthermore, language like parenting is multi-dimensional. The findings suggest that there is a relationship between some dimensions of parenting and an omnibus measurement of language. In this instance, language has multiple domains (e.g., vocabulary, morphology, phonology, syntax and semantics) reflecting its multi-dimensional nature. Consequently, it is plausible that the nature of the influences from more optimal parenting in terms of these particular dimensions (responsiveness, affect and achievement orientation) is broadly distributed across the language system. Because of the omnibus nature of the measure of language, and treating language as an underlying latent construct, it is possible that these parenting dimensions might influence particular domains of language (e.g., lexical development), which can result in a higher language score. Therefore, further research is needed to further advance our knowledge of how parenting dimensions (e.g., responsiveness, affect and achievement orientation) influence the components of language so appropriate health promotions as well as

clinical implications can be proposed. It appears that specific dimension of parenting may have broad ranging or more specific impacts on language and this needs further investigation, not only to understand the links between parenting and language outcomes, but to highlight which factors to optimally target during intervention.

In contrast to the observational approach, when parenting behaviours were assessed using parent-reported questionnaires, the results showed that there was no effect between parenting behaviours (namely, Emotional Warmth, Punitive Discipline, Autonomy Support, Permissive Discipline, and Democratic Discipline) and children's language outcomes. The findings of the current study also showed that there are possible patterns in the effects in which parenting behaviours were measured. In particular, the observation approach appears to be a better predictor of children's outcomes. This supports the findings of past research (Collins et al., 2000; Hill et al., 2008; Kochanska et al., 1989; Sessa, Avenevoli, Steinberg, & Morris, 2001; Smith, 2011; Zaslow et al., 2006). Thus the current findings in this study emphasise the fundamental issue for researchers and clinicians that different approaches may yield different results when assessing the multifaceted nature and complexity of parenting.

The findings of this research emphasise that different methods have important implications for the type and validity of the results or information obtained. One of the practical implications of the findings from this study is the recommendation of the use of observation approach to evaluate and provide practical parent training intervention for children with language disorders. In the Hanen program for Parents (Manolson, 1992), for example, parents with children who are experiencing language difficulties could learn to support the child's early language intervention through different parenting behaviours such as responsiveness, teaching and scaffolding (Girolametto, Pearce, & Weitzman, 1996a, 1996b, 1997; Weitzman, Girolametto, & Greenberg, 2006). Observation could assist parents to support and encourage behaviours that the child is already capable of, whilst adapting and responding appropriately to the child's needs. Such parent training could adapt and support the child's outcomes, and more importantly, this provides the empowerment for parents to work with what they already know. For example, with children who might experience language difficulties, optimal parenting behaviours such as the parental

affect could be incorporated into effective learning strategies as in the Hanen programme (Girolametto et al., 1996a, 1996b, 1997). As a further example, clinicians and parents could use positive affect such as verbal praise to encourage the child to accomplish a reading or writing task.

#### **8.4 The Relationship between Motor and Language Development**

The results of Study 1 and Study 2 which replicated the findings on a sub-set of participants from Study 1, indicate that fine motor skills were related to language outcomes. This supports the findings of past research (Campos et al., 2000; Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Oller et al., 1999; Viholainen et al., 2006; Vukovic et al., 2010; Wang et al., 2014). The relationship between fine motor skills and language outcomes could be explained by a shared underlying neurocognitive mechanism perhaps at the level of the cerebellum that plays a critical role in the visual spatial function or visual guided movement (Attig et al., 1991; Botez et al., 1985; Bracke-Tolkmit et al., 1989; Petrosini et al., 1998; Wallesch and Horn, 1990), and coordination of sequential motor movements (Halsband et al., 1993; Kelso, 1997; Picard & Strick, 2001; Simmonds et al., 2008). Some researchers have demonstrated during verbal working-memory and finger movement tasks, that functional magnetic resonance imaging shows the cerebellum is activated, indicating the cerebellum could facilitate the phonological loop (Desmond, Gabrieli, Wagner, Ginier, & Glover, 1997). This is consistent with the past research revealing that there is a relationship between visuospatial working memory, verbal working memory, and motor ability in a normal sample of school-aged children (Piek et al., 2004; Rigoli, Piek, Kane, & Oosterlaan, 2012; Rigoli et al., 2013).

Desmond et al. (1997) demonstrated the close co-activation of the right inferior cerebellar hemisphere and frontal lobe structures (including the Broca's area that consists of articulatory control system and temporal-parietal structures that includes the supramarginal gyrus consisting of the phonological store) when understanding the relationship between verbal working-memory and motor tasks. More specifically, Desmond et al. (1997) highlighted that smooth and swift update of the phonological loop requires predictive control of articulatory control processes, in the same manner as predictive control is needed for swift coordination movements, indicating that articulatory control processes are engaged by both verbal working-memory and

motor tasks. Although it is speculative in nature, it is plausible that shared underlying cerebellar processes could be partly accounted for the specific relationship found in the current study.

Another plausible explanation for finding that fine motor skills are related to language outcomes is that development in both domains may be related to the level of maturity of brain development. This has been proposed for example for children born prematurely (Jongmans, Henderson, de Veries, & Dubowitz, 1993; Le Normand, Vaivre-Douret, & Delfosse, 1995). Similarly, Piek, Pitcher and Hay (1999) have demonstrated a co-occurrence between children with different developmental disorders, such as dyslexia and attention deficit hyperactivity disorder, and motor difficulties. This further suggests that a broader impairment of the nervous system could account for co-occurrence of motor and language deficits.

Researchers (e.g., Mundy et al., 2003) have pointed out that motor abilities are one of the underlying factors that contribute to early social communication in young children with autism, including non-verbal requests (reaching for a toy), initiating joint attention (pointing to a toy), and responding to joint attention (following a verbal direction to look at a toy), suggesting that there is a strong association between motor and emergent literacy development. This notion is consistent with past research that suggests motoric behaviours such as early vocalization could be an underlying factor for learning and acquisition of complex skills such as language (Eilers et al., 1993; Fagan & Iverson, 2007; Iverson, 2010; Mundy et al., 2007; Oller et al., 1999; Oller, 2010). Early social communication such as connectivity-dependence and joint attention, for example, could enable the child to actively respond and solicit the parent's attention, which in turn, facilitates the child's language development. Past studies have also revealed that common and early-learned verbs (such as kick, run, clap and open) are strongly associated specific actions by specific body parts or movements (Maouene, Hidaka, & Smith, 2008). More particularly, the functional magnetic resonance imaging scans showed that the regions of the right premotor cortex that process motor input were activated when participants listened to learned verbs, suggesting functional links between motor and language outcomes in typically developing children aged four to six years (James & Maouene, 2009).

The current findings support this proposal given the consistent finding of a pathway from motor to language ability. The findings in this study have practical implications for assessments, and developing and tailoring intervention programs, particularly for children with motor and language difficulties. In this instance, it is important for clinicians or therapists to assess children's motor abilities, for example, when they present with language difficulties. However, the results in the current study do not imply causality. Therefore the specific relationship between motor and language outcomes still needs to be clarified to understand best how co-occurring deficits in both domains may be treated for optimal benefit.

### **8.5 Self-Report Assessment versus Observation**

Importantly, the findings of this research clearly demonstrated that different results can be obtained when different research methods are used to measure parenting behaviours. In particular, observation was a better predictor of children's outcomes as compared to parent-reported assessments, suggesting that observational method might be a better representative of parenting behaviours. The findings in the current study are supportive of past studies that reveal observation in comparison to parent-report questionnaire is more consistent and reliable when assessing parenting behaviours (Collins et al., 2000; Hill et al., 2008; Kochanska et al., 1989; Smith, 2011; Zaslow et al., 2006). The results from Study 1 are consistent with a prospective cohort study of 1,766 mother-child dyads conducted by Zubrick et al. (2007), where their results reveal that parenting behaviours (and family characteristics such as family household income, ethnicity, mother's age, education level and mental health) have no significant influence on late language emergence. In Zubrick et al.'s (2007) study, the Parenting Scale (Arnold et al., 1993) was used to measure parenting behaviours that include permissive discipline, authoritarian discipline and verbosity.

Therefore, it is plausible that the equivocal findings in the present study could have been attributed to some of the limitations associated with using a parent-reported assessment. Whilst the PBDQ (Reid et al., 2012) was developed systematically with sound psychometric properties, some researchers have pointed out that the inconsistent findings when using self-report assessment could be explained for example, by its inability to assess the dynamics and complexity of parent-child interactions (Hill et al., 2008), and this method could be affected by

most noticeable and more recent events (Stone & Shiffman, 2002; Zaslow et al., 2006). Another limitation for using self-report assessment is that less optimal parenting behaviours such as permissive, neglect, harsh, and punitive discipline are difficult or rare to match with the sample, and commonly under-represented in parenting research (Driscoll et al., 2008; Gaylord-Harden et al., 2010; Kapinus & Gorman, 2004; Landry et al., 2006; Lieb et al., 2000; Lorber et al., 2011; Mahoney et al., 2000; Mallinckrodt, 1992; Spokas & Heimberg, 2009).

Past studies have also shown that data obtained from observation may represent more stable and trait-like propensities in parenting behaviours such as intrusive or directive behaviours that are not influenced by systematic biases such as the informant's expectations, positive or negative attributions to the child, and mood (Prescott et al., 2000; Sessa et al., 2001; Taber, 2010). Some researchers have pointed out that although parents have been used as the key informant in parenting research, their reports may be under-represented, particularly with parenting behaviours that involve negative disciplinary strategies such as permissive discipline and punitive discipline (Prescott et al., 2000; Taber, 2010). Previous studies have also demonstrated that there is a stronger association between observer (during a parent-child interaction) and child-reported parenting when compared with child and mother reports of parenting behaviours or between mother and observer reports (Sessa et al., 2001).

Taken together, Studies 1 and 2 demonstrate that the different approaches to measuring parenting could yield different results when assessing parenting behaviours. More importantly, extending from Studies 1 and 2, the results in Study 3 reveal that the parenting constructs between PDBQ and MBRS-R were not correlated. Punitive Discipline was found to be correlated with Directiveness, as was Democratic Discipline with Achievement Orientation, suggesting that the different dimensions of parenting behaviours in two different parenting measures may be associated. The findings in the present study reinforced the existing literature that multiple dimensions of parenting behaviours may be more accurate to the central constructs of parenting behaviours (Caron et al., 2006; Reid et al., 2012; Skinner et al., 2005).

Although the results in the present study do not imply causality, it appears that the two sets of interrelated constructs such as Punitive Discipline and Directiveness, for example, could be part of a control dimension of parenting. This notion is supported by past studies demonstrating that parents who endorsed more items of authoritarian/restrictive parenting on the Q-Sort (Block, 1981) questionnaire are closely associated with the use of direct and controlling strategies observed during parent-child interaction, whereas endorsement of authoritative/democratic parenting is associated with relatively indirect, positive and autonomy support (Kochanska et al., 1989).

Some researchers have pointed out that accurate and meaningful parenting behaviours can be drawn from multiple dimensions of parenting behaviours, and perhaps more importantly, they can also distinguish each parenting behaviour from related constructs (Skinner et al., 2005). Multiple dimensions of parenting behaviours, for example, could be used to represent one set of parenting behaviour to capture the different combinations of parenting behaviours under a single theme (Skinner et al., 2005). In this instance, it appears disaggregated parenting dimensions (autonomy support and psychological control) may be more useful instead of focusing on aggregated (autonomy support versus psychological control) parenting behaviours (Skinner et al., 2005; Reid et al., 2012). More importantly, disaggregated parenting dimensions could provide a single, most important and ubiquitous dimension of parenting. As the MBRS-R was developed based on disaggregated parenting dimensions, this provides a plausible explanation for the different results obtained in the present study.

Furthermore, Zaslow et al. (2006) notes that when different approaches, including mother-reported assessments (items for warmth, control and aggravation were drawn from the Parental Attitudes Toward Child-Rearing Scale; Easterbrooks & Goldberg, 1984, and the Parenting Stress Index; Abidin, 1986), an interview and the observation method based on the HOME Short Form (Baker & Mott, 1989; Bradley & Caldwell, 1984) are used to assess parenting, all three measurements showed different degrees of predictive capabilities on children's developmental outcomes. In this instance, the results showed the observational method to be the strongest and consistent predictor of cognitive and socio-emotional outcomes in

preschool children, whereas the weakest predictor was from self-report measures. This is consistent with the findings in the current study. Consequently, the current study provides the evidence that different approaches to assess parenting behaviours could have significant implications for the validity and the type of information that can be obtained.

## **8.6 Strengths of Study**

One of the major strengths of the present study was it is aimed to measure and compare different dimensions of parenting behaviours using two different approaches which were known to have good psychometric properties. Also to the author's knowledge, the present study is the first study that has been carried out to investigate the relationships between parenting behaviours, and motor and language development using two different parenting measures. The findings in the present study also provide evidence that it is important to clearly differentiate each dimension of parenting (and from related parenting constructs), and more importantly, it also extends our knowledge that core parenting behaviours might be better represented by using multiple dimensions of parenting behaviours, which is consistent with the existing literature (Reid, 2012; Skinner et al., 2005). This not only addresses the current confusion of different terminologies used in parenting research, but could also expand the development of an accurate and comprehensive assessment of parenting behaviours in the future.

Some researchers have pointed out that parents may display some behaviours but not others because parents' personal characteristics and other contextual factors may influence certain parenting behaviours (McFadden & Tamis-LeMonda, 2013). This is consistent with past research that has commonly found it difficult to find participants with less optimal parenting behaviours associated with harsh, neglect, rejection, corporal punishment, and punitive discipline (Driscoll et al., 2008; Gaylord-Harden et al., 2010; Kapinus & Gorman, 2004; Landry et al., 2006; Lieb et al., 2000; Lorber et al., 2011; Mahoney et al., 2000; Mallinckrodt, 1992; Spokas & Heimberg, 2009). Therefore, using two different parenting measures can be more sensitive in capturing and detecting changes in parenting behaviours. Furthermore, the use of multiple informants (mothers and trained raters) could also increase the criterion validity of the observed behaviours.

Other strengths related to this study are the control of potential confounding variables including child's age, verbal and non-verbal IQ, mother's age and educational level, family income and ethnicity. Moreover, stringent procedures were used in the observational method, in which rater(s) were systematically trained to code observed behaviours. In addition, standardised protocols were carefully observed to eliminate possible variance that commonly occurs in the observational method. This included videotaped 20 minute periods of mother-child free play without the presence of an observer in a naturalistic setting. In addition, five minutes of warm-session was included and mother-child interactive behaviours were systematically coded during 10 of the 20 minutes free play. Also, although issues related to statistical analyses were identified, including that multivariate normality was not met, transformation of data was not employed so that the integrity of the data remained intact. Although this research has significant strengths, there were some limitations that warranted further discussion.

### **8.7 Limitations of Study**

In the present study, the mother-child dyads mainly consisted of families with above average household income and mothers who held a university degree or higher qualification. Consequently, it is possible that these parents may be more involved and valued "good parenting". This supports the current findings that suggested the sample scored highly on self-report assessments, indicating that participants endorsed more positive items that reflect optimal parenting (emotional warmth) rather than negative items that reflect less optimal parenting (punitive discipline). This is consistent with the results that punitive discipline had no impact on children's motor and language development. If this is deemed to be true, the sample did not represent the full range of parenting behaviours, but more importantly, it also poses a limitation to the study in so far as the results failed to examine some of the parenting behaviours that have been identified in past research. Furthermore, restriction in range can also affect correlations and relationships to the broader population which consequently may not be detected.

Thus, these limitations could have elevated the degree of social desirability bias, in which more positive items were endorsed in the questionnaires. Furthermore, past research suggests that self-report assessment is highly susceptible to social

desirability biases (Bornstein & Xlotnik, 2008; Paulhus, 1991). Therefore, this limitation could have contributed to the inconsistent findings in this study, in which, because of social desirability biases, participants could have endorsed more of the positive items (over-represented) and far fewer of the negative items (underestimated) in Study 1. Consequently, such variability could also have contributed to a ceiling effect, which means the majority of scores fell at or near the maximum possible score or upper limit for the observed variable. This unexpected statistical artefact is a form of measurement error that can lead to inflation of the type I error rate, in which rejecting the null hypothesis where in fact the results were true. This assumption is consistent with the results in this study that indicate a narrowed range of scores and negatively skewed distributions for Emotional Warmth, Autonomy Support, Permissive Discipline, and Democratic Discipline.

Although potential confounding variables, including child's verbal and non-verbal IQ, mother's age and educational level, family income and ethnicity were controlled, other factors that might affect parenting behaviours such as disposition of parent and child were not ruled out in this study. For example, previous studies have suggested there are strong associations between depression and parenting behaviours, particularly with less optimal parenting behaviours such as punitive discipline, permissive discipline, and negative/coercive behaviour (Feldman et al., 2009; Lovejoy et al., 2000). Dispositions of the parent such as a history of depression, for example, could have affected the quality of the parent's responses to the child's cues and needs. Depressed parents who are experiencing significant negative emotions such as sadness and hopelessness, for example, could engage in greater levels of inconsistent discipline strategies when disciplining their child, which in turn, may influence the parents' beliefs and confidence in their parenting role. Other confounding factors such as maternal anxiety and stress (Belsky, 1984; Feldman et al., 2009) that might contribute to the variability in parenting behaviours, were also not included in this study.

Although mother-child interactions were observed in the home, providing some ecological validity, they were being overtly videotaped. It is plausible that the videotaping might have changed the actual interactive behaviours between mothers and their child, although some researchers have pointed out that mother-child

interaction does not alter when videotaped within a naturalistic setting (Brooks & Lewis, 1974). In addition, some researchers have pointed out that parenting behaviours such as parental responsiveness and affect often changed in order to adapt and respond to the child's changing developmental needs across different developmental stages (Taylor, Anthony, & Aghara, 2008; Landry et al., 2001, 2012; Steelman et al., 2002; Wyman et al., 1999).

The present study hypothesized that motor development mediated the relationship between parenting behaviours and language development in young children, however, the result obtained did not support these hypotheses. Although there is strong empirical evidence supporting the selected model in the present study, there is a possible alternative model that could explain as to why parenting behaviours could affect the relationship between motor and language development instead. As suggested by some researchers, parenting behaviours play a critical role on children's motor (Cress et al., 2008; Lomax-Bream et al., 2007; Treyvaud et al., 2009) and language (Karrass & Braungart-Rieker, 2003; Kubicek & Emde, 2012; Hughes et al., 1999; Murray & Hornbaker, 1997; Perkins et al., 2013; Tamis-LeMonda et al., 2014; Tamis-LeMonda et al., 2004; Taylor et al., 2009; Vismara et al., 2013) development.

Responsive parents, for example, are more likely to become the child's primary socializing partner from infancy through childhood. Such engaging environment is likely to increase children opportunities to acquire and practice their motor abilities, which in turn, enhance and modify the child's learning environment that is beneficial to his or her language acquisition. Some researchers (Adolph et al., 2012; Clearfield, 2011; Karasik, Tamis-LeMonda, & Adolph, 2011) have also pointed out that children spontaneous actions or activities (e.g., carrying object, accessing distant objects and sharing objects with mothers) is one of the key foundations of motor learning and changes in developmental changes (e.g., more refined mother-child interactions, particularly when directing mother's attention to specific objects). As it is beyond the scope of the current study, further investigation is rendered to examine other possible alternative model associated with parenting behaviours, motor and language development.

Finally, because the generalization of the links between parenting, and motor and language abilities in the current study focused on a typically developing sample

rather than clinical sample, further investigation is needed before clear clinical implications can be proposed. Whilst the limitations associated with the present study have been identified, suggestions for future research are discussed in the next section.

## **8.8 Future Direction**

Furthermore, it is not known, based on the findings in the present study, whether the relationship between parenting, and motor and language development is a reflection of current dynamics and developmental processes (in four year old children), or whether part of this relationship is explained by there being a link between these factors early in development (e.g., in infancy) that sets a trajectory for the child. The critical point of interaction may have been early in development that sets the stage for the child. This notion is consistent with dynamic systems theory that patterns of developmental changes in young children occurs constantly through mutual, multiple, and constant interaction of all levels of the developing system, including language, imitation, social relationships, perception, experience and action, and parent-child interaction (Courage & Howe, 2002; Fogel, 2000; Gershkoff-Stowe, 2002; Gogate, 2001; Johnson, 2001; MacWhinney, 1999).

Some researchers have pointed out that parenting behaviours often alter in order to adapt and respond to the child's changing developmental needs over different development stages (Taylor et al., 2008; Landry et al., 2012; Wyman et al., 1999). Although the findings in the present study did not support the prediction of the possible causal relationship between parenting, and motor and language development, replication of the results is recommended by using a longitudinal study.

Moreover, different populations including non-clinical and clinical samples could be employed concurrently in future studies so that generalisability could be extended to more diverse populations. For example, clinical samples such as children with developmental coordination disorders and specific language impairments, should be reviewed. Past research has shown that there is a commonality of co-morbidity in children with language disorders and motor impairments (Adi-Japha et

al., 2011; Hill, 2001; Jäncke et al., 2007; Rechetnikov & Maitra, 2009; Ullman & Pierpont, 2005; Webster et al., 2005; Wisdom et al., 2006).

Past studies have also suggested there was a significant difference between fathers and mothers' ratings of their preschool children's social-emotional functioning including social skills, temperament, behaviour problems and competency (Walker & Bracken, 1996). For example, fathers of children with delayed motor or typically developing children when compared to mothers, fathers tended to employ task-oriented interactive style and they are less likely to adjust their interactions to suit the child's developmental level (Ganadaki & Magill-Evans, 2003). Thus future research could include more diverse samples of both mothers and fathers with a different racial-ethnic composition, different educational levels and different socioeconomic status.

Furthermore, past research has revealed that although fathers and mothers demonstrated similar levels of affect, achievement orientation and directiveness when interacting with their children, mothers in comparison to fathers tended to be more responsive during play session (Chiarello et al., 2006). Thus future research could extend our understanding to provide different interactive strategies to both parents in order to support and provide an optimal and responsive learning environment, particularly for children who might be experiencing motor and language difficulties. More importantly, such information could assist in the development of early intervention programs that incorporate targeted parent to child interactive behaviour strategies.

Although the findings in the present study suggested that there might be a relationship between phonological development and motor development, more specific measures of phonology processing, such as non-word repetition, could be used in future research to determine whether the link between motor and broader language skills is mediated via the phonological system. According to Baddeley, Gathercole and Papagno (1998), phonological working memory is a critical mechanism for language learning, particularly for vocabulary development. Thus future research is warranted as the present study cannot tease out these specific relationships because of the omnibus measure of language.

Other factors such as parental mental health (such as depression, anxiety and stress), and a child's personality traits (such as temperament), that may have been contributing factors in parenting behaviours, should be included in future research. This could also provide information about the levels of agreement within the family context with regard to the observed behaviours. Some researchers have pointed out that parenting behaviours (such as directiveness) may not be stable and consistent over time (Cuzell & Vernon-Feagans, 2004), thus multiple informants of parenting behaviours would provide a stronger theoretical framework for examining effects, particularly with such diverse comparisons involving more than one point in time, that will likely be of particular value.

Although different dimensions of parenting behaviours appear to be correlated, such as Punitive Discipline and Directiveness, for example, it remains unclear if these parenting behaviours reflect parental psychological control or behaviour control. Furthermore, some researchers have pointed out that optimal parenting behaviours such as authoritative parenting may not be related to the parenting control dimension (Gray & Steinberg, 1999). Future research is recommended to further evaluate the psychometric properties of different parenting measures (such as PBDQ and MBRS-R), in which convergence between these two measures could provide a set of standardised parenting constructs which can reliably predict children's developmental outcomes.

## **8.9 Conclusions**

To our knowledge this study presents the first evaluation of the relationships between parenting behaviours, and motor and language outcomes in a normative sample of typically developing children aged four to six years and their mothers. The results of this study did not support our hypotheses that there was a mediational relationships between parenting, and motor and language development, although the results suggested that the observation approach when compared to self-report assessment was a stronger predictor of the relationship between parenting behaviours and children's fine motor skills and language outcomes. The current findings also showed that fine motor skills were related to language outcomes. Lastly, the results suggested that the parenting constructs between MBRS-R and PBDQ were not related, although Punitive Discipline was moderately correlated with Directiveness,

as was the correlation between Democratic Discipline and Affect and Achievement Orientation, suggesting that these parenting behaviours could be part of the same dimension.

This study has advanced our knowledge that the observational approach may be more sensitive and reliable in detecting changes in parenting behaviours. This further suggests that disaggregating dimensions of parenting behaviours might be more accurate and meaningful to describe core parenting behaviours. The findings of this study have also supported the existing literature that parenting behaviours play an important role in children's developmental outcomes, particularly motor and language developments. Furthermore, this study has practical implications for assessments and developing and tailoring intervention programs, particularly for children with motor and language difficulties. Moreover, it is important to advance our knowledge about the protective role and possible risk factor of parenting behaviours in children's developmental outcomes, particularly with atypically developing children when parents may play a significant role in early intervention.

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# Appendix A

## Approval from Human Research Ethics Committee of Curtin University

### Memorandum

To	Professor Jan Piek, School of Psychology and Speech Pathology
From	Assoc/Prof Stephan Millett, Chair, Human Research Ethics Committee
Subject	Protocol Approval HR 01/2011
Date	03 March 2011
Copy	Ms Lee Poh Choo, School of Psychology and Speech Pathology Dr Neville Hennessey, School of Psychology and Speech Pathology

Office of Research and Development

Human Research Ethics  
Committee

TELEPHONE 9266 2784

FACSIMILE 9266 3793

EMAIL hrec@curtin.edu.au

Thank you for your application submitted to the Human Research Ethics Committee (HREC) for the project titled "*The relationship between Mother-child interaction and motor ability in children with and without specific language impairment*". Your application has been reviewed by the HREC and is **approved**.

- You have ethics clearance to undertake the research as stated in your proposal.
- The approval number for your project is **HR 01/2011**. *Please quote this number in any future correspondence.*
- Approval of this project is for a period of twelve months **01-03-2011 to 01-03-2012**. To renew this approval a completed Form B (attached) must be submitted before the expiry date **01-03-2012**.
- If you are a Higher Degree by Research student, data collection must not begin before your Application for Candidacy is approved by your Faculty Graduate Studies Committee.
- The following standard statement **must be** included in the information sheet to participants:  
*This study has been approved by the Curtin University Human Research Ethics Committee (Approval Number HR 01/2011). The Committee is comprised of members of the public, academics, lawyers, doctors and pastoral carers. Its main role is to protect participants. If needed, verification of approval can be obtained either by writing to the Curtin University Human Research Ethics Committee, c/- Office of Research and Development, Curtin University, GPO Box U1987, Perth, 6845 or by telephoning 9266 2784 or by emailing hrec@curtin.edu.au.*

Applicants should note the following:

It is the policy of the HREC to conduct random audits on a percentage of approved projects. These audits may be conducted at any time after the project starts. In cases where the HREC considers that there may be a risk of adverse events, or where participants may be especially vulnerable, the HREC may request the chief investigator to provide an outcomes report, including information on follow-up of participants.

The attached **FORM B** should be completed and returned to the Secretary, HREC, C/- Office of Research & Development:

When the project has finished, or

- If at any time during the twelve months changes/amendments occur, or
- If a serious or unexpected adverse event occurs, or
- 14 days prior to the expiry date if renewal is required.
- An application for renewal may be made with a Form B three years running, after which a new application form (Form A), providing comprehensive details, must be submitted.

Regards,



A/Professor Stephan Millett  
Chair Human Research Ethics Committee

PP

## Appendix B

Approval from Department of Education, Western Australia



Government of **Western Australia**  
Department of **Education**

Your ref :  
Our ref : D11/0282263  
Enquiries :

Ms Lee Poh Choo  
School of Psychology  
Curtin University of Technology  
GPO Box U1987  
PERTH WA 6845

Dear Ms Lee

Thank you for your completed application received 14 April 2011 to conduct research on Department of Education sites.

The focus and outcomes of your research project, *The Relationship between Mother - Child interaction and Motor Ability in Children With and Without Specific Language Impairment*, are of interest to the Department. I give permission for you to approach site managers to invite their participation in the project as outlined in your application. It is a condition of approval, however, that upon conclusion the results of this study are forwarded to the Department at the email address below.

Consistent with Department policy, participation in your research project will be the decision of the schools invited to participate, individual staff members, the children in those schools and their parents. A copy of this letter must be provided to site managers when requesting their participation in the research. Researchers are required to sign a confidential declaration and provide a current Working with Children Check upon arrival at the Department of Education site.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The Department notes a copy of a letter confirming that you have received ethical approval of your research protocol from the Bio Human Research Ethics Committee, Curtin University.

Any proposed changes to the research project will need to be submitted for Department approval prior to implementation.

Please contact Ms Allison McLaren, R/Evaluation Officer, on (08) 9264 4607 or [researchandpolicy@det.wa.edu.au](mailto:researchandpolicy@det.wa.edu.au) if you have further enquiries.

Very best wishes for the successful completion of your project.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Alan Dodson'.

ALAN DODSON  
DIRECTOR  
EVALUATION AND ACCOUNTABILITY

12 May 2011

151 Royal Street, East Perth Western Australia 6004

# Appendix C

Approval from Catholic Education Office, Western Australian



21 June 2011

Ms Christina Lee  
School of Psychology and Speech Pathology  
Curtin University  
GPO Box U1987  
PERTH WA 6845

Dear Christina

**RE: THE RELATIONSHIP BETWEEN MOTHER-CHILD INTERACTION AND  
MOTOR ABILITY IN CHILDREN WITH AND WITHOUT SPECIFIC LANGUAGE IMPAIRMENT**

Thank you for your completed application received 17 June 2011, whereby this project will explore the predictions from two board theoretical frameworks, a dynamic systems approach and a neurobiological approach, relating to the development of children's motor and language ability. In particular, this study aims to examine the quality of different mother-child interaction behaviours that could significantly affect a child's motor and language abilities.

I give in principle support for the selected Catholic schools in Western Australia to participate in this valuable study. However, consistent with CEOWA policy, participation in your research project will be the decision of the individual principal and staff members.

The conditions of CEOWA approval are as follows:

1. As your research project is being conducted for longer than one year, a completion of annual reports as well as a final report are to be forwarded to the CEOWA.
2. Due to your research being conducted for longer than the date that your institute's ethics approval is valid for, it is a condition of CEOWA approval that before 1 March 2012 a new ethics approval letter from your respective institute is forwarded to CEOWA.

Responsibility for quality control of ethics and methodology of the proposed research resides with the institution supervising the research. The CEOWA notes that the Curtin University Human Research Ethics Committee has granted permission for this research project until 1 March 2012 (Approval Number: HR 01/2011).

Any changes to the proposed methodology will need to be submitted for CEOWA approval prior to implementation. The focus and outcomes of your research project are of interest to the CEOWA. It is therefore a condition of approval that the research findings of this study are forwarded to the CEOWA.

Further enquiries may be directed to Tanya Davies at [davies.tanya@ceo.wa.edu.au](mailto:davies.tanya@ceo.wa.edu.au) or (08) 6380 5379.

I wish you all the best with your research.

Yours Sincerely

Ron Dullard

50 Ruislip Street, Leederville WA 6007 PO Box 198, Leederville WA 6903 T (08) 6380 5210 F (08) 6380 5110  
E [dullard.ron@ceo.wa.edu.au](mailto:dullard.ron@ceo.wa.edu.au) W [ceo.wa.edu.au](http://ceo.wa.edu.au)

# Appendix D

## Information Letter for School

### **Mother-Child Interaction, Motor Ability, and Language Ability: Are They Related?**

My name is Christina Lee Roberts and I am writing to you on behalf of Curtin University. I am conducting a research project as part of my doctoral studies that aims to assess children's interaction skills with their mother and movement ability in children aged 4 to 6 years, who may or may not have Specific Language Impairment.

Research has found that there is a relationship between how a mother interacts with her child and the movement ability of the child. Research has also shown that this can influence their language development. My study will extend our understanding of the extent to which parents' guidance and teaching of children's action and behaviour influence their development. The project is carried out with my supervisors at Curtin University, Professor Jan Piek (Primary Supervisor), Dr. Neville Hennessy (Co-Supervisor), Dr. Bob Kane (Associate Supervisor), and Mary Claessen (Associate Supervisor).

I would like to invite your school to take part in those projects.

### **What does participation in the research project involve?**

I seek access to all kindergarten and pre-primary students aged 4 to 6 years and their mothers.

- **Three widely recognised standardised measures (e.g., MABC, CELF and WPSSI) will be administered for "FREE" to assess the child's motor ability, language ability, and cognitive functioning.**

Assessment will include a mixture of tasks such as manual dexterity, catching and aiming, balancing, receptive and expressive language, as well as understanding about things.

Below are the examples of what are required from the participants:-

*School Site: A group assessment will be take place on the school's site. Each child will be required to complete the MABC, CELF and WPSSI that take about 1.5 hours. These standardised measures will be administered for "free."*

*Child's Home (optional): Video-taping of free play between mother and child for about 20 minutes at home. This will be followed by a parenting questionnaire which is expected to take about 15 minutes to complete.*

For participants who agree to participate in the video-taping, both mother and child are invited to share a *Free Play* session at a time that suits the participants in their home for about 20 minutes. This session will be video-taped.

Participants will also be asked to fill out two screening questionnaires (assessing demographic and child's medical history).

I will keep the school's involvement in the administration of the research procedures to a minimum. However, it will be necessary for the school to send home with students the information letters and consent forms for students and their parents.

### **To what extent is participation voluntary, and what are the implications of withdrawing that participation?**

Participation in this research project is entirely voluntary.

If any member of a participant group decides to participate and then later changes their mind, they are able to withdraw their participation at any time.

Once a decision is made to participate, participants can change their mind at any time within the minimum 5-year storage period of the research data. All contributions made to the project will be destroyed unless explicitly agreed to by you.

If the project has already been published at the time the participants decide to withdraw, participants' contributions that were used in reporting the project cannot be removed from the publication.

There will be no consequences relating to a decision by the participants to participate or not, or to participate and then withdraw, other than those already described in this letter. Decisions made will not affect the relationship with the research team or Curtin University.

**What will happen to the information collected, and is privacy and confidentiality assured?**

Information that identifies anyone will be removed from the data collected. The data is then stored securely in hard and electronic copy at the School of Psychology and Speech Pathology, Curtin University, and can only be accessed by the research team. The data will be stored for a minimum period of 5 years, after which it will be destroyed. This will be achieved by deleting all electronic data and shredding data which is on hard copy.

The data is maintained in a way that enables us to re-identify an individual's data and destroy it if participation is withdrawn. This is done by using a system of individual codes, known only to the research team, which is used to link each individual's consent form to all data that relate to that individual.

The identity of the child will not be disclosed at any time, except in circumstances that require reporting under the Department of Education *Child Protection* policy, or where the research team is legally required to disclose that information.

Participant privacy, and the confidentiality of information disclosed by participants, is assured at all other times.

The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from participants.

It is intended that the findings of this study are published in a journal and/or presented at a conference. A summary of the research findings will also be made available upon completion of the project. You can access this by contacting me on the number provided, and expect it to become available in end of 2013.

**Is this research approved?**

The research has been approved by the Curtin University Human Research Ethics Committee (Protocol Approval Number: HR 01/2011), and has met the policy requirements of the Department of Education (Reference Number: D11 / 0282263).

**Do all members of the research team who will be having contact with children have their Working with Children Check?**

Under the Working with Children (Criminal Record Checking) Act 2004, people undertaking research that involves contact with children must undergo a Working with Children Check. We are also happy to provide you with copies if you have any concerns.

**Who do I contact if I wish to discuss the project further?**

If you would like to discuss any aspect of this study with a member of the research team, please contact me on **9266 3436** (*email: pohchoo.lee@postgrad.curtin.edu.au*) or my Supervisor, Professor Jan Piek on 9266 7990. If you wish to speak with an independent person about the project, please contact Linda Teasdale, Ethics Committee Secretary, by telephoning 9266 2784.

**How do I indicate my willingness for the school to be involved?**

If you have had all questions about the project answered to your satisfaction, and are willing for the school to participate, please complete the **Consent Form** on the following page.

This information letter is for you to keep.

Christina Lee Roberts  
Provisional Psychologist  
PhD Candidate

# Appendix E

## Consent Form for School

### Mother-Child Interaction, Motor Ability, and Language Ability: Are They Related?

- I have read this document and understand the aims, procedures, and risks of this project, as described within it.
- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.
- I am willing for the school to become involved in the research project, as described.
- I understand that participation in the project is entirely voluntarily.
- I understand that the school is free to withdraw its participation at any time, without affecting the relationship with the research team or Curtin University.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed. Also, all contributions made to the project will be destroyed unless explicitly agreed to by the school.
- I understand that if the project has already been published in a journal at the time the school decide to withdraw, the contribution that was used in reporting the project cannot be removed from the publication.
- I understand that this research will be published in a journal and/or presented at a conference, provided that the participants or the school are not identified in any way.
- I understand that the school will be provided with a copy of the findings from this research upon its completion.

Name of Site Manager (printed):

\_\_\_\_\_

Name of School:

\_\_\_\_\_

Contact Number:

\_\_\_\_\_

Signature:

\_\_\_\_\_

Date: / /

## **Appendix F - Removed**

# Appendix G

## PARENT QUESTIONNAIRE

**INSTRUCTIONS:** Please read each item carefully and answer ALL questions by circling or filling-in the blanks

### A. MOTHER's DETAILS:

- (1) Name: ..... (2) Date of birth: .....
- (3) Marital status: a. married/defacto (4) No. of children: a. only child  
b. divorced b. 2 children  
c. widowed c. 3 children  
d. single d. 3 children and more  
e. separated
- (5) Educational level: a. postgraduate (6) Ethnicity: a. Aboriginal  
b. undergraduate b. Australian  
c. diploma c. Asian  
d. apprentice/technical d. Torres Strait Islander  
e. high school – years 11 to 12 e. Others (please specific)  
f. high school – years 8 to 10 .....
- (7) Family income: a. \$80,000 and above 8) Occupation: .....  
b. \$50,000 to \$79,999  
c. \$30,000 to \$49,000  
d. \$30,000 and below

### B. CHILD's DETAILS:

- (1) Name: ..... (2) Date of birth: .....
- (3) Sex: M / F
- (4) Do your child has any known:
- a. **medical conditions (e.g., Asthma)** yes / no  
If yes, please specify: .....
- b. **neurological problems (e.g., Cerebral Palsy)** yes / no  
If yes, please specify: .....
- c. **auditory and/or visual deficits** yes / no  
If yes, please specify: .....
- d. **learning difficulties** yes / no  
If yes, please specify: .....
- e. **motor coordination problems** yes / no  
If yes, please specify: .....

# Appendix H

## Information Letter for Parent

### **Mother-Child Interaction, Motor Ability, and Language Ability: Are They Related?**

Dear Parent/Carer,

Hello,

My name is Christina Lee Roberts and I am conducting a research project as part of my doctoral studies at Curtin University. My project aims to understand the relationship between language and movement ability in children aged 4 to 6 years 11 months. My study also looks at how children interact with their mothers and how this interaction might support their language and motor development.

Because this study is designed to focus only on typical development in children, if your child has a diagnosed medical or neurological condition that affects development, then please disregard this letter.

We know from previous research that fathers play an important role in children's development, however the scope of this particular study only allows us to look at the mother's role.

We also know from past research that there are complex relationships between how children interact with their mothers and the ways that children develop their movement and language abilities. My study aims to extend our understanding of the way in which mothers support children's motor and language development. We hope the findings of this study will provide useful information to all parents, as well as contribute to the development of effective early intervention programs for children who are at risk of language delays or motor coordination difficulties. This project is carried out with my supervisors at Curtin University, Professor Jan Piek (Primary Supervisor), Dr. Neville Hennessy (Co-Supervisor), Dr. Bob Kane (Associate Supervisor), and Mary Claessen (Associate Supervisor).

We would like to invite you and your child to take part in this project.

#### **What does participation in the research project involve?**

We will use three widely recognised measures to help us to understand your child's motor ability, language ability, and thinking skills.

**We will assess your child's motor, language and thinking abilities at your child's school.** The assessments will involve fun activities that look at manual dexterity, catching and aiming, and balancing. Other activities involve looking at your child's understanding of words and sentences and how your child expresses his or her understanding in their speech. Other activities will assess your child's thinking and reasoning skills. For example, your child will be asked to sort some picture cards to form a sequence, and organize some shapes. Your child will be assessed individually by me or one of our trained research assistants. The total assessment time will take about 1.5 hours, which includes lots of time for breaks.

An assessment report will be provided regardless of your child's result. The standardised measures used in this study are only an assessment tool. Such tools only give an indication if there is an area of concern and you should seek further assessment should any area of concern be identified.

We will also ask you to fill out a questionnaire to get some background information on your child, and complete a Parenting Behaviours and Dimensions Questionnaire. Finally, you and your child will be invited to participate in an optional free-play session.

During this session you will be asked to just play with your child with toys, activities or board-games for approximately 20 minutes. With your consent the session will be video taped for later analysis. As with all data we collect for this study the tapes will be kept confidential and stored securely at Curtin

University before being destroyed (see below for details). The play session can be undertaken in your home for your convenience and at a time that suits you.

### **Do I or my child have to take part?**

No. Participation in this research project, including the additional video play session, is completely voluntary.

If you do not want your child to take part in the project, or your child does not wish to take part, then they simply do not. This decision should always be made completely freely, and any and all decisions are respected by members of the research team.

Your child has also been provided with a letter from us that we encourage you to discuss with him/her.

### **What if either of us was to change our mind?**

Either you or your child can change your mind and withdraw from the study at any time within the minimum 5-year storage period of the research data (see below). All contributions made to the project will be destroyed after five years unless explicitly agreed to by you.

If the project has already been published at the time you and your child decide to withdraw, your child's contribution that was used in reporting the project cannot be removed from the publication.

There will be no consequences relating to a decision by you and your child to participate or not, or to participate and then withdraw, other than those already described in this letter.

### **What will happen to the information collected, and is privacy and confidentiality assured?**

Information that identifies anyone will be removed from the data collected. The data are then stored securely at the School of Psychology and Speech Pathology, Curtin University, and can only be accessed by the research team. The data will be stored for a minimum period of 5 years after the study is completed, after which the data will be destroyed.

The recorded video session is only reviewed by the Principal Investigator, Supervisors and three trained raters. The raters will sign a confidentiality agreement. The raters are an important part of the video analysis because they will not know the children. They will help the team analyse in an unbiased way how mothers and children interact.

The data are maintained in a way that enables us to re-identify an individual's data and destroy it if participation is withdrawn. This is done by using a system of individual codes, known only to the Principal Investigator, which is used to link each individual's consent form to all data that relate to that individual.

The identity of your child will not be disclosed at any time, except in circumstances where the research team is legally required to disclose that information. Participant privacy, and

the confidentiality of information disclosed by participants, is assured at all other times. The data will be used only for this project, and will not be used in any extended or future research without first obtaining explicit written consent from you and your child.

### **What are the benefits of this research for my child's education?**

Although your child's participation may not directly benefit their education, this project is important as it will extend our understanding of the way in which a mother supports her child's motor and language development.

This understanding may lead in the future to better ways of intervening to help children maximise their potential for development in language and movement. A summary of the research findings will also be made available upon completion of the project. You can obtain a copy of this summary from your child's school. We expect the summary to become available in September, 2013.

Also, you will be informed if the scores suggest any difficulties in the areas assessed (movement, language, and cognitive) and recommendations will be made for suitable services should you wish to follow up further assessment and/or treatment. If you give your permission, your child's teacher will also be informed.

### **Are there any risks associated with participation?**

The risks associated with participation in the study are very small. In fact, a number of the assessment tasks are quite fun for children. Some children and/or parents may feel uncomfortable being video-taped. Should any distress arise the session will be stopped immediately. I will provide a list of recommended child and family counselling services if required.

Whenever needed short breaks will be provided for your child.

Please note that the assessments alone do not diagnose any delay or disorder in development. However, they may indicate a low scoring child is at risk and so further assessment will be recommended.

### **How do I know that the people involved in this research have all the appropriate documentation to be working with children?**

Under the Working with Children (Criminal Record Checking) Act 2004, people undertaking research that involves contact with children must undergo a Working with Children Check. I am also happy to provide you with copies if you have any concerns. Also our research assistants doing the testing are all psychology students in their fourth year who have been trained to administer the assessments in a standardised procedure.

### **Is this research approved?**

The research has been approved by the Curtin University Human Research Ethics Committee (Protocol Approval Number: HR 01/2011), and has met the policy requirements of the Department of Education (Reference Number: D11 / 0282263).

### **Who do I contact if I wish to discuss the project further?**

If you would like to discuss any aspect of this study with a member of the research team, please contact me on **9266 3436** (*email: pohchoo.lee@postgrad.curtin.edu.au*) or my Supervisor, Professor Jan Piek on 9266 7990. If you wish to speak with an independent

person about the project, please contact The Secretary of the Curtin University Human Research, by telephoning 9266 2784.

**How does my child become involved?**

Please ensure that you:

- discuss what it means to take part in the project with your child before you both make a decision; and
- take up my invitation to ask any questions you may have about the project.

Once all questions have been answered to your satisfaction, and you and your child are both willing to become involved, please complete the attached **Consent Form (Parent and Child)** and kindly return the form to me at the School of Psychology and Speech Pathology, Curtin University or you may return the complete consent form to your child's teacher in the envelope provided.

This project information letter is for you to keep.

Christina Lee Roberts  
Provisional Psychologist  
PhD Candidate

# Appendix I

## Information Sheet for Young Children

### **Mother-Child Interaction, Motor Ability, and Language Ability: Are They Related?**

Hello

My name is Christina Lee Roberts. I have a project that you might like to help me with.

The project is about getting to know how you learn to play, walk, run, jump, and talk with your mummy.

Would you like to help me for about 1.5 hours?

If you want to stop at anytime, that's OK, you can.

I won't tell anyone what you say while helping me with the project, unless I need to tell someone like your teacher if you have problem moving about, talking, and understanding about other things.

Your parents, or the person who looks after you, have talked with you about helping with the project.

If you would like to help with the project, please draw a circle around the thumb that points up on the next page.

If you don't want to help with the project – that's OK too.

# Appendix J

## Consent Form for Parent

Mother-Child Interaction, Movement and Language: Are They Related?

- I have read this document, or have had this document explained to me in a language I understand, and I understand the aims, procedures, and risks of this project, as described within it.
- For any questions I may have had, I have taken up the invitation to ask those questions, and I am satisfied with the answers I received.
- I understand that participation in the project is entirely voluntarily.
- I am willing to become involved in the project, as described.
- I understand that I am free to withdraw that participation at any time within 5 years of project completion.
- I understand that data will be stored securely for a minimum period of 5 years, after which it will be destroyed. Also, all contributions made to the project will be destroyed unless explicitly agreed to by myself.
- I give permission for the contribution that I make to this research to be published in a journal and/or presented at a conference, provided that I or my child are not identified in any way.
- I understand that a summary of findings from the research will be made available to me and my child upon its completion.

Name of Parent/Carer (printed): \_\_\_\_\_

Name of Child (printed): \_\_\_\_\_

Contact Number: \_\_\_\_\_

Home Address: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

# Appendix K

## Consent Form for Young Children

### Mother-Child Interaction, Motor Ability, and Language Ability: Are They Related?

- I know I have a choice whether or not I want to do this project
- I know that I can stop whenever I want.
- I know that I will be playing with my mummy for 20 minutes as well as doing activities looking at movement, speaking, and understanding about things.
- I know that I need to draw a circle around the thumb that points up on this page before I can help with the project.



I would like to help with  
the project



I do not want to help  
with the project

Name of child: \_\_\_\_\_

Today's Date: \_\_\_\_\_

## **Appendix L - Removed**

# Appendix M

## SPSS and LISREL Outputs for Study 1

(1) Descriptive Statistics for Child's Age, Gender and Grade

### Statistics

age at testing

N	Valid	183
	Missing	0
Mean		4.9660
Std. Deviation		.84526
Minimum		4.00
Maximum		6.11

### sex

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid male	100	54.6	54.6	54.6
female	83	45.4	45.4	100.0
Total	183	100.0	100.0	

### grade

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Kindy	73	39.9	39.9	39.9
Pre-primary	54	29.5	29.5	69.4
Year 1	56	30.6	30.6	100.0
Total	183	100.0	100.0	

(2) Descriptive Statistics for Mothers and Families Characteristics

**Statistics**

Demographic Questionnaire 2a -

Mother's age

N	Valid	183
	Missing	0
Mean		36.76
Std. Deviation		5.114
Minimum		24
Maximum		48

**Demographic Questionnaire 3 - Mother's marital status**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	4	2.2	2.2	2.2
	Married or Defacto	166	90.7	90.7	92.9
	Separated	3	1.6	1.6	94.5
	Divorced	10	5.5	5.5	100.0
	Total	183	100.0	100.0	

**Demographic Questionnaire 5 - Mother's educational level**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	highschool 8-10 years	13	7.1	7.1	7.1
	highschool 11-12 years	31	16.9	16.9	24.0
	apprentice/technical	8	4.4	4.4	28.4
	Diploma	18	9.8	9.8	38.3
	university degree	96	52.5	52.5	90.7
	university postgrad	17	9.3	9.3	100.0
	Total	183	100.0	100.0	

**Demographic Questionnaire 6a - Ethnicity**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Australian	149	81.4	81.4	81.4
	Indigenous Australian or Torres Strait Islander	4	2.2	2.2	83.6
	north and west European	7	3.8	3.8	87.4
	Southern European	1	.5	.5	88.0
	eastern european	1	.5	.5	88.5
	Africa	1	.5	.5	89.1
	Middle-Eastern	1	.5	.5	89.6
	Asian	15	8.2	8.2	97.8
	white SA	4	2.2	2.2	100.0
	Total	183	100.0	100.0	

**Demographic Questionnaire 7 - Family income**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30,000 and below	20	10.9	10.9	10.9
	30,000 to 49,000	24	13.1	13.1	24.0
	50,000 to 79,999	15	8.2	8.2	32.2
	80,000 and above	118	64.5	64.5	96.7
	Missing	6	3.3	3.3	100.0
	Total	183	100.0	100.0	

**Demographic Questionnaire 4 - Number of children**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	only child	9	4.9	4.9	4.9
	2 children	89	48.6	48.6	53.6
	3 children	32	17.5	17.5	71.0
	more than 3 children	4	2.2	2.2	73.2
	Missing	49	26.8	26.8	100.0
	Total	183	100.0	100.0	

(3) Descriptive Statistics for Key Measures

*Parenting behaviours*

**Statistics**

		PBDQ Emotional Warmth subscale - Mean Score	PBDQ Punitive Discipline subscale - Mean Score (reversed score)	PBDQ Autonomy Support subscale - Mean Score	PBDQ Permissive Discipline subscale - Mean Score	PBDQ Democratic Discipline subscale - Mean Score
N	Valid	183	183	183	183	183
	Missing	0	0	0	0	0
Mean		5.5301	4.8270	5.0426	4.3248	5.3082
Std. Deviation		.37693	.54534	.51498	.59983	.49911
Skewness		-1.077	-.259	-1.192	-.542	-.626
Std. Error of Skewness		.180	.180	.180	.180	.180
Kurtosis		1.207	.035	2.664	.360	.131
Std. Error of Kurtosis		.357	.357	.357	.357	.357
Minimum		4.17	3.00	3.00	2.50	3.60
Maximum		6.00	6.00	6.00	5.67	6.00

*Motor*

**Statistics**

		MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score
N	Valid	183	183	183
	Missing	0	0	0
Mean		9.65	10.34	11.03
Std. Deviation		2.771	3.014	3.215
Skewness		.149	.047	.286
Std. Error of Skewness		.180	.180	.180
Kurtosis		.487	.549	-.706
Std. Error of Kurtosis		.357	.357	.357
Minimum		2	1	5
Maximum		19	19	18

*Language*

**Statistics**

		CELF - Receptive Language Index - Standard Score	CELF - Expressive Language Index - Standard Score
N	Valid	183	183
	Missing	0	0
Mean		101.07	100.91
Std. Deviation		11.697	12.749
Skewness		-.148	-.188
Std. Error of Skewness		.180	.180
Kurtosis		-.118	.880
Std. Error of Kurtosis		.357	.357
Minimum		66	61
Maximum		128	140

IQ

**Statistics**

		WPSSI-III Verbal IQ - Composite Score	WPSSI-III Performance IQ - Composite Score
N	Valid	183	183
	Missing	0	0
Mean		104.22	98.89
Std. Deviation		13.627	15.233
Minimum		72	73
Maximum		141	144

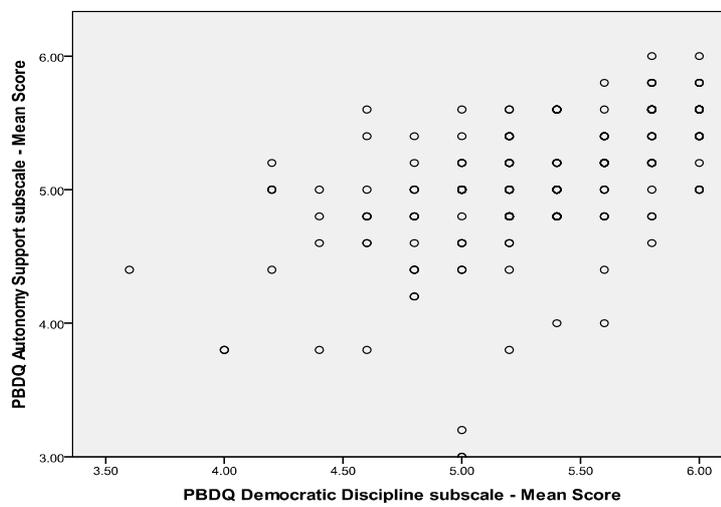
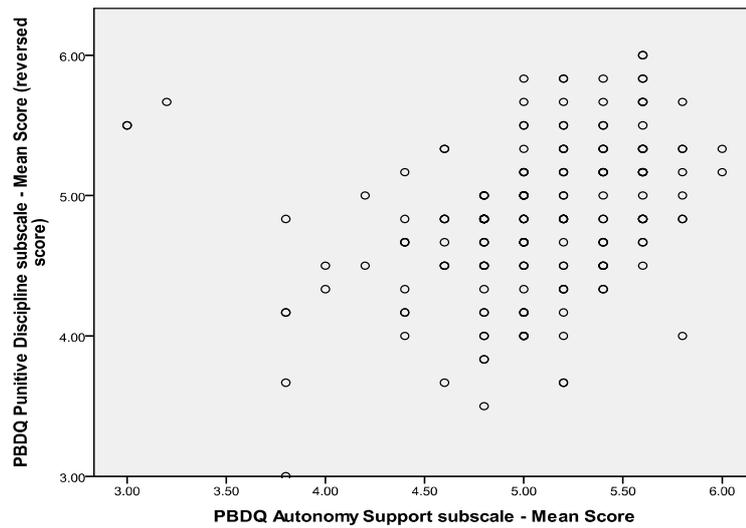
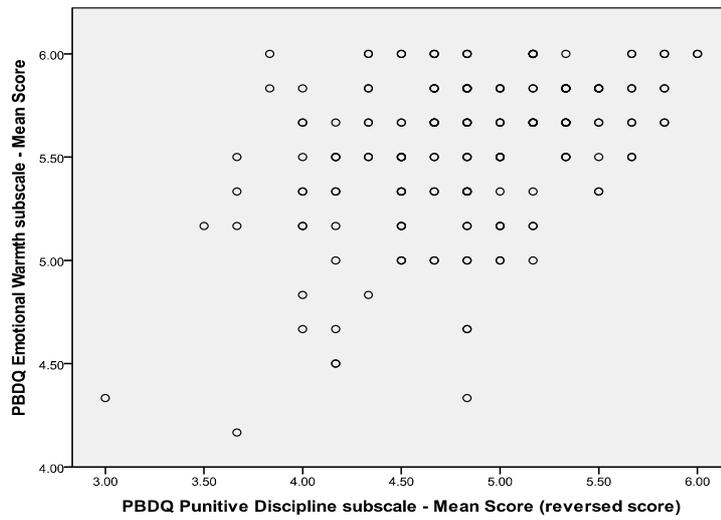
(4) Correlations among Indicators: Pearson Correlations above Diagonal, Spearman Correlations below Diagonal ( $N = 183$ )

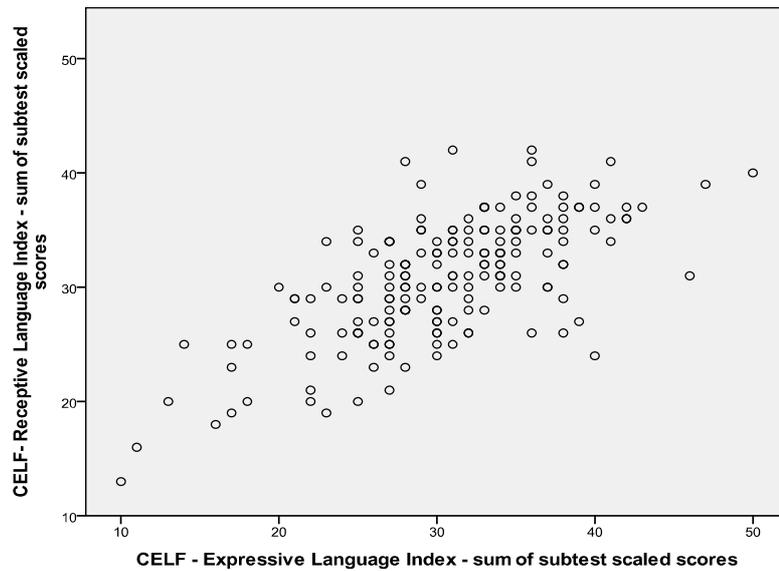
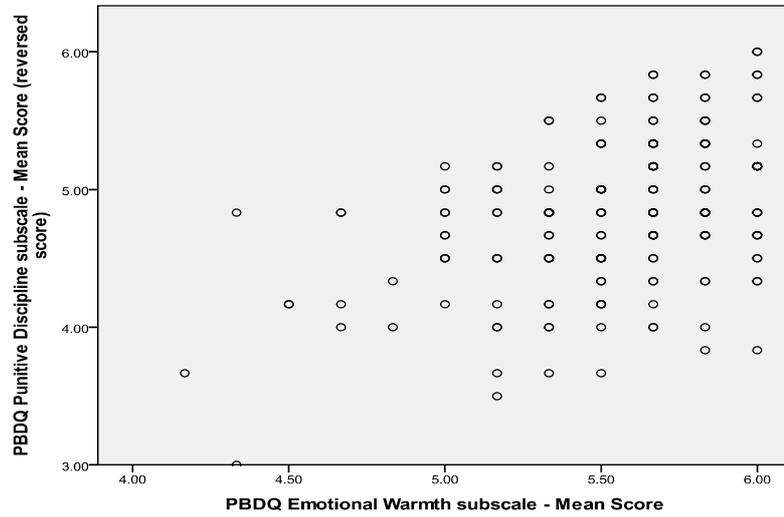
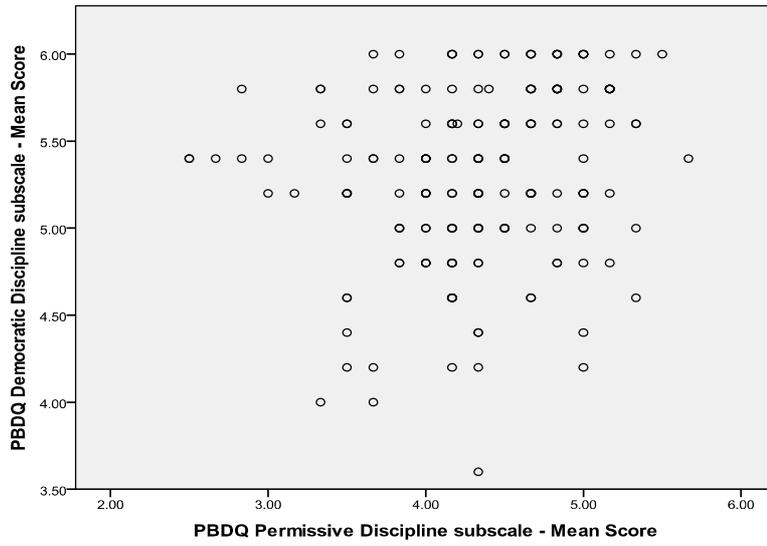
Control Variables	PBDQ Emotional Warmth	PBDQ Punitive Discipline	PBDQ Autonomy Support	PBDQ Democratic Discipline	PBDQ Permissive Discipline	MABC-2 Manual Dexterity -	MABC-2 Aiming and Catching -	MABC-2 Balance -	CELF- Receptive Language	CELF - Expressive Language
PBDQ Emotional Warmth	<b>1.000</b>	<b>.430**</b>	<b>.476**</b>	<b>.559**</b>	.027	-.124	-.110	-.088	-.118	-.044
PBDQ Punitive Discipline	<b>.383**</b>	<b>1.000</b>	<b>.309**</b>	<b>.348**</b>	<b>.297**</b>	<b>-.161*</b>	-.043	-.042	-.095	.062
PBDQ Autonomy Support	<b>.489**</b>	<b>.399**</b>	<b>1.000</b>	<b>.528**</b>	<b>.201**</b>	-.048	-.065	.027	-.010	.028
PBDQ Democratic Discipline	<b>.544**</b>	<b>.309**</b>	<b>.576**</b>	<b>1.000</b>	<b>.181*</b>	-.013	-.015	.043	.025	.060
PBDQ Permissive Discipline	.090	<b>.304**</b>	<b>.282**</b>	<b>.218**</b>	<b>1.000</b>	.052	.039	.109	.023	.058
MABC-2 Manual Dexterity	-.143	<b>-.167*</b>	-.065	-.033	.010	<b>1.000</b>	<b>.249**</b>	<b>.329**</b>	<b>.216**</b>	<b>.167*</b>
MABC-2 Aiming and Catching	-.076	-.064	-.041	-.024	.023	<b>.256**</b>	<b>1.000</b>	.119	.024	-.045
MABC-2 Balance	-.125	-.056	.002	.044	.067	<b>.335**</b>	.128	<b>1.000</b>	<b>.156*</b>	<b>.218**</b>
CELF- Receptive Language	-.096	-.104	-.063	.011	-.043	<b>.226**</b>	.055	.133	<b>1.000</b>	<b>.678**</b>
CELF -Expressive	-.081	-.032	.042	.061	-.009	<b>.176*</b>	-.025	<b>.208**</b>	<b>.644**</b>	<b>1.000</b>

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

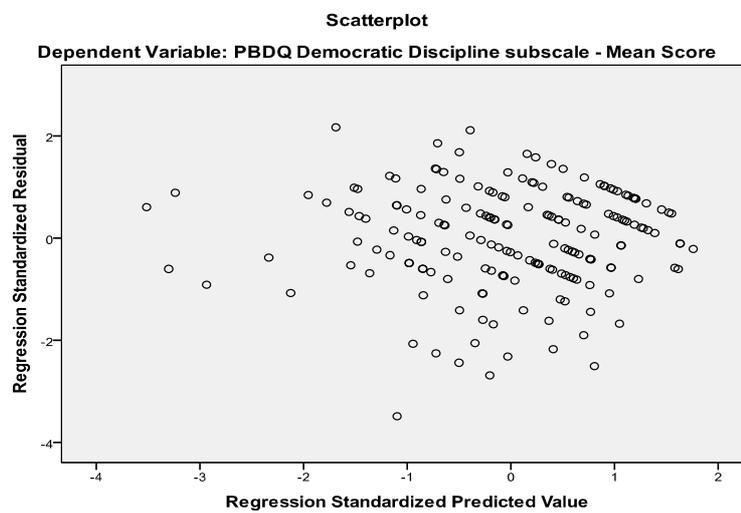
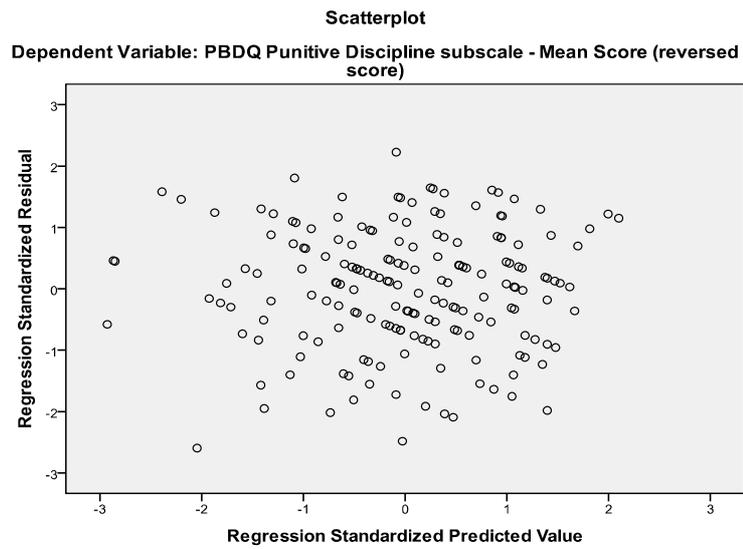
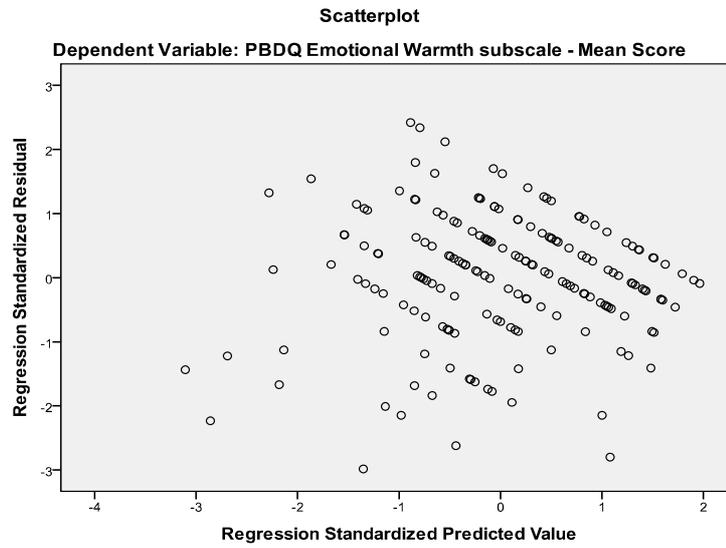
\*\* . Correlation is significant at the 0.01 level (2-tailed).

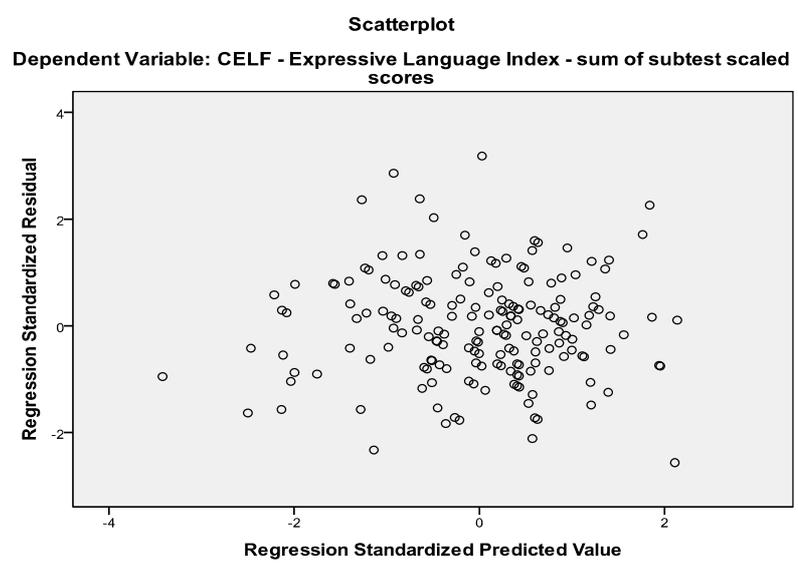
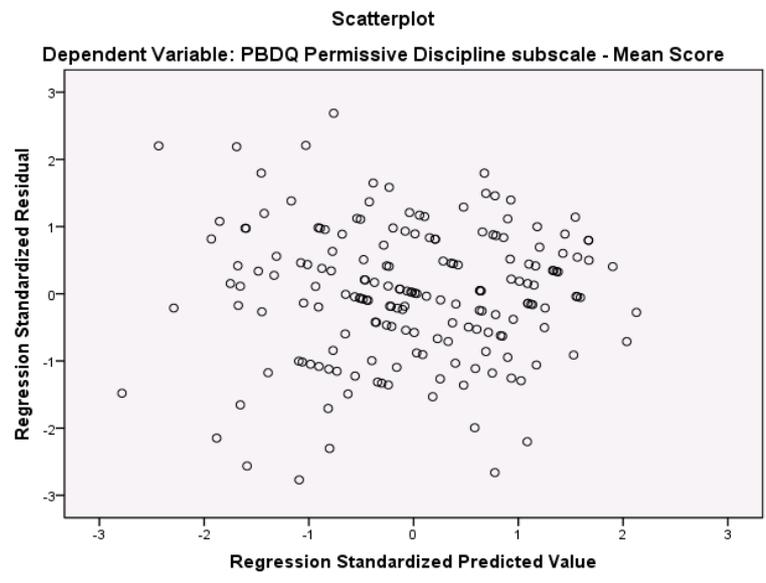
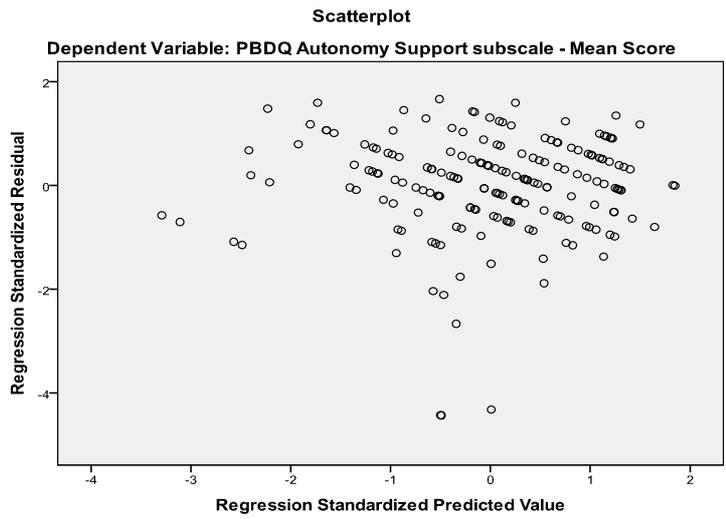
(5) Scatterplots for Key Variables: Assumption of Linearity (Samples)

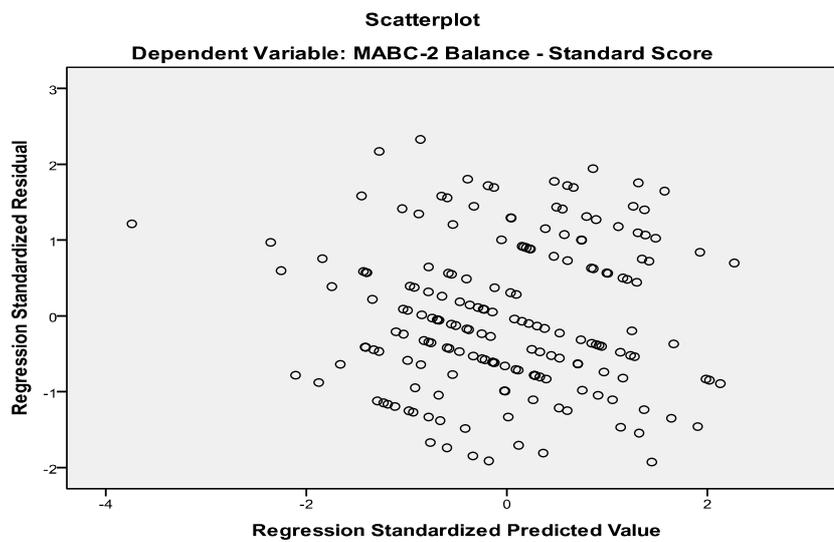
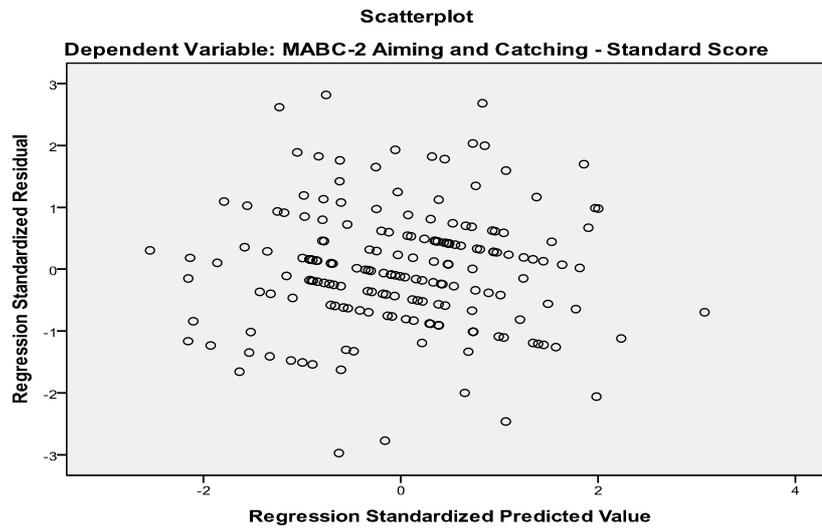
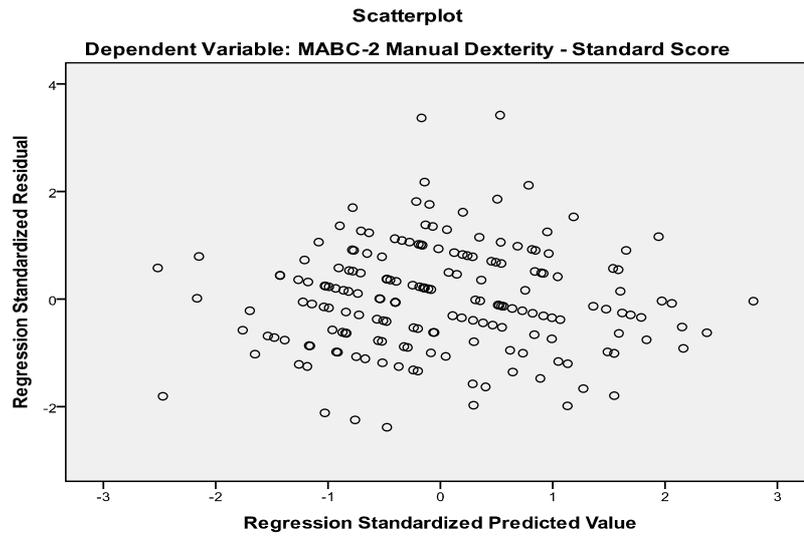




(6) Scatterplots for Key Variables: Assumption of Homoscedasticity (Samples)







(7) Pearson's Correlation for Potential Confounding Variables (N = 183)

	MBRS Respon sive sub scale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achieve ment - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Stan dard Score	MABC-2 Aiming and Catching - Stan dard Score	MABC-2 Balance - Stan dard Score	CELF- Recept ive Lan guage Index - sum of subtest scaled scores	CELF - Express ive Lan guage Index - sum of subtest scaled scores
sex	.173	.199	.119	-.089	.078	.102	.094	.158	.075
age_at_testing	-.173	-.078	-.042	-.007	-.076	.051	-.172	-.221	-.293
Demographic Questionnaire 2a - Mother's age	<b>.324**</b>	<b>.243*</b>	.183	-.032	<b>.222*</b>	.052	.174	<b>.393**</b>	<b>.324**</b>
Demographic Questionnaire 5 - Mother's educational level	<b>.225*</b>	<b>.239*</b>	<b>.215*</b>	.121	-.006	.045	.127	.054	.103
Demographic Questionnaire 7 - Family income	.164	.109	.202	-.007	.002	.070	.141	.212	<b>.272*</b>
Ethnic_Group	<b>-.322**</b>	<b>-.307**</b>	<b>-.317**</b>	.108	-.181	.134	-.094	-.213	<b>-.323**</b>
WPSSI-III Verbal IQ - Scaled Score	<b>.531**</b>	<b>.401**</b>	<b>.402**</b>	.142	.185	.104	.092	<b>.525**</b>	<b>.465**</b>
WPSSI-III Performance IQ - Scaled Score	<b>.223*</b>	<b>.223*</b>	.156	.208	.136	.160	-.032	<b>.340**</b>	.061

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

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

1: 1 = Australian, 2 = Others

(8) Pearson's Correlation for Key Measures ( $N = 183$ )

	MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score	CELF- Receptive Language Index - sum of subtest scaled scores	CELF - Expressive Language Index - sum of subtest scaled scores
MBRS Responsive subscale - Mean Score	1	<b>.762**</b>	<b>.691**</b>	.080	<b>.304**</b>	.002	<b>.336**</b>	<b>.637**</b>	<b>.599**</b>
MBRS Affect subscale - Mean Score	<b>.655**</b>	1	<b>.811**</b>	-.051	<b>.244*</b>	.165	.199	<b>.564**</b>	<b>.475**</b>
MBRS Achievement - Mean Score	<b>.573**</b>	<b>.756**</b>	1	.054	<b>.373**</b>	.144	.167	<b>.602**</b>	<b>.591**</b>
MBRS Directive - Mean Score	.049	-.144	.021	1	.182	-.008	.094	.053	.012
MABC-2 Manual Dexterity - Standard Score	.213	.156	<b>.347**</b>	<b>.250*</b>	1	.214	<b>.254*</b>	<b>.344**</b>	<b>.231*</b>
MABC-2 Aiming and Catching - Standard Score	-.053	.157	.141	-.065	.214	1	.058	.053	-.056
MABC-2 Balance - Standard Score	<b>.275*</b>	.116	.092	.121	<b>.229*</b>	.068	1	<b>.240*</b>	<b>.245*</b>
CELF- Receptive Language Index - sum of subtest scaled scores	<b>.475**</b>	<b>.437**</b>	<b>.532**</b>	.002	<b>.228**</b>	-.027	.177	1	<b>.703**</b>
CELF - Expressive Language Index - sum of subtest scaled scores	<b>.395**</b>	<b>.308**</b>	<b>.477**</b>	.018	<b>.247*</b>	-.070	.131	<b>.625**</b>	1

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

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

## LISREL output for Study 1: Model 1

### (9a) Structural model

Goodness of Fit Statistics

Degrees of Freedom = 16  
Minimum Fit Function Chi-Square = 47.281 (P = 0.000)  
Normal Theory Weighted Least Squares Chi-Square = 49.075 (P = 0.000)  
Estimated Non-centrality Parameter (NCP) = 33.075  
90 Percent Confidence Interval for NCP = (15.686 ; 58.083)

Minimum Fit Function Value = 0.260  
Population Discrepancy Function Value (F0) = 0.182  
90 Percent Confidence Interval for F0 = (0.0862 ; 0.319)  
Root Mean Square Error of Approximation (RMSEA) = 0.107  
90 Percent Confidence Interval for RMSEA = (0.0734 ; 0.141)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00383

Expected Cross-Validation Index (ECVI) = 0.489  
90 Percent Confidence Interval for ECVI = (0.394 ; 0.627)  
ECVI for Saturated Model = 0.396  
ECVI for Independence Model = 1.366

Chi-Square for Independence Model with 28 Degrees of Freedom = 232.615  
Independence AIC = 248.615  
Model AIC = 89.075  
Saturated AIC = 72.000  
Independence CAIC = 282.290  
Model CAIC = 173.265  
Saturated CAIC = 223.542

Normed Fit Index (NFI) = 0.797  
Non-Normed Fit Index (NNFI) = 0.732  
Parsimony Normed Fit Index (PNFI) = 0.455  
Comparative Fit Index (CFI) = 0.847  
Incremental Fit Index (IFI) = 0.856  
Relative Fit Index (RFI) = 0.644

Critical N (CN) = 124.179

Root Mean Square Residual (RMR) = 0.0831  
Standardized RMR = 0.0831  
Goodness of Fit Index (GFI) = 0.937  
Adjusted Goodness of Fit Index (AGFI) = 0.858  
Parsimony Goodness of Fit Index (PGFI) = 0.416

### (9b) Measurement and structural components

#### Structural Equations

manual = - 0.153\*parent, Errorvar.= 0.977 , R<sup>2</sup> = 0.0235  
(0.0981) (0.130)  
-1.561 7.535

aim = - 0.0672\*parent, Errorvar.= 0.995 , R<sup>2</sup> = 0.00452  
(0.0984) (0.131)  
-0.683 7.613

bal = - 0.0401\*parent, Errorvar.= 0.998 , R<sup>2</sup> = 0.00161  
(0.0985) (0.131)  
-0.408 7.625

```

lang = 0.199*manual + 0.00282*aim + 0.0919*bal - 0.0622*parent,
Errorvar.= 0.943 , R| = 0.0566
(0.376)      (0.0955)      (0.0911)      (0.0916)      (0.0992)
2.507      2.087      0.0309      1.003      -0.628

```

### (9c) Correlations between Latent Variables

Correlation Matrix of Independent Variables

	parent	manual	aim	bal	lang
parent	1.000				
manual	-0.137 (0.097)	1.000			
aim	-1.415 -0.047 (0.098)	0.325 (0.085)	1.000		
bal	-0.477 -0.013 (0.098)	3.822 0.396 (0.081)	0.194 (0.090)	1.000	
lang	-0.137 -0.088 (0.098)	4.871 0.238 (0.090)	2.154 0.073 (0.092)	0.158 (0.091)	1.000
	-0.897	2.653	0.789	1.730	

### (9d) Measurement model

#### Goodness of Fit Statistics

Degrees of Freedom = 13  
 Minimum Fit Function Chi-Square = 14.553 (P = 0.336)  
 Normal Theory Weighted Least Squares Chi-Square = 13.945 (P = 0.378)  
 Estimated Non-centrality Parameter (NCP) = 0.945  
 90 Percent Confidence Interval for NCP = (0.0 ; 14.243)

Minimum Fit Function Value = 0.0800  
 Population Discrepancy Function Value (F0) = 0.00519  
 90 Percent Confidence Interval for F0 = (0.0 ; 0.0783)  
 Root Mean Square Error of Approximation (RMSEA) = 0.0200  
 90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0776)  
 P-Value for Test of Close Fit (RMSEA < 0.05) = 0.743

Expected Cross-Validation Index (ECVI) = 0.329  
 90 Percent Confidence Interval for ECVI = (0.324 ; 0.402)  
 ECVI for Saturated Model = 0.396  
 ECVI for Independence Model = 1.366

Chi-Square for Independence Model with 28 Degrees of Freedom = 232.615  
 Independence AIC = 248.615  
 Model AIC = 59.945  
 Saturated AIC = 72.000  
 Independence CAIC = 282.290  
 Model CAIC = 156.763  
 Saturated CAIC = 223.542

Normed Fit Index (NFI) = 0.937  
 Non-Normed Fit Index (NNFI) = 0.984  
 Parsimony Normed Fit Index (PNFI) = 0.435  
 Comparative Fit Index (CFI) = 0.992  
 Incremental Fit Index (IFI) = 0.993  
 Relative Fit Index (RFI) = 0.865

Critical N (CN) = 347.287

Root Mean Square Residual (RMR) = 0.0393  
Standardized RMR = 0.0393  
Goodness of Fit Index (GFI) = 0.981  
Adjusted Goodness of Fit Index (AGFI) = 0.948  
Parsimony Goodness of Fit Index (PGFI) = 0.354

## LISREL output for Study 1: Model 2

### (10a) Structural model

Goodness of Fit Statistics (structural model)

Degrees of Freedom = 6  
Minimum Fit Function Chi-Square = 31.882 (P = 0.000)  
Normal Theory Weighted Least Squares Chi-Square = 33.283 (P = 0.000)  
Estimated Non-centrality Parameter (NCP) = 27.283  
90 Percent Confidence Interval for NCP = (12.790 ; 49.281)

Minimum Fit Function Value = 0.175  
Population Discrepancy Function Value (F0) = 0.150  
90 Percent Confidence Interval for F0 = (0.0703 ; 0.271)  
Root Mean Square Error of Approximation (RMSEA) = 0.158  
90 Percent Confidence Interval for RMSEA = (0.108 ; 0.212)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.000395

Expected Cross-Validation Index (ECVI) = 0.348  
90 Percent Confidence Interval for ECVI = (0.268 ; 0.469)  
ECVI for Saturated Model = 0.231  
ECVI for Independence Model = 0.847

Chi-Square for Independence Model with 15 Degrees of Freedom = 142.082  
Independence AIC = 154.082  
Model AIC = 63.283  
Saturated AIC = 42.000  
Independence CAIC = 179.338  
Model CAIC = 126.425  
Saturated CAIC = 130.399

Normed Fit Index (NFI) = 0.776  
Non-Normed Fit Index (NNFI) = 0.491  
Parsimony Normed Fit Index (PNFI) = 0.310  
Comparative Fit Index (CFI) = 0.796  
Incremental Fit Index (IFI) = 0.810  
Relative Fit Index (RFI) = 0.439

Critical N (CN) = 96.974

Root Mean Square Residual (RMR) = 0.0909  
Standardized RMR = 0.0909  
Goodness of Fit Index (GFI) = 0.943  
Adjusted Goodness of Fit Index (AGFI) = 0.799  
Parsimony Goodness of Fit Index (PGFI) = 0.269

### (10b) Measurement and structural components

#### Structural Equations

manual = - 0.191\*parent, Errorvar.= 0.963 , R<sup>2</sup> = 0.0366  
(0.0918) (0.128)  
-2.084 7.518

aim = - 0.128\*parent, Errorvar.= 0.984 , R<sup>2</sup> = 0.0163  
(0.0922) (0.130)  
-1.385 7.581

bal = - 0.163\*parent, Errorvar.= 0.973 , R<sup>2</sup> = 0.0265  
(0.0920) (0.129)  
-1.769 7.550

$lang = 0.187*manual - 0.00673*aim + 0.0716*bal - 0.155*parent,$   
 Errorvar.= 0.921 , R<sup>2</sup> = 0.0795  
 (0.0939) (0.0909) (0.0918) (0.0961)  
 (0.314) 1.992 -0.0741 0.781 -1.615  
 2.930

### (10c) Correlations between latent variables

Correlation Matrix of Independent Variables

	parent	manual	aim	bal	lang
parent	1.000				
manual	-0.171 (0.091)	1.000			
aim	-1.891 -0.110 (0.092)	0.325 (0.085)	1.000		
bal	-1.198 -0.144 (0.091)	3.822 0.396 (0.081)	0.194 (0.090)	1.000	
lang	-1.577 -0.197 (0.090)	4.871 0.237 (0.089)	2.154 0.073 (0.092)	0.155 (0.091)	1.000
	-2.187	2.658	0.799	1.709	

### (10d) Measurement model

#### Goodness of Fit Statistics

Degrees of Freedom = 3  
 Minimum Fit Function Chi-Square = 2.033 (P = 0.566)  
 Normal Theory Weighted Least Squares Chi-Square = 2.021 (P = 0.568)  
 Estimated Non-centrality Parameter (NCP) = 0.0  
 90 Percent Confidence Interval for NCP = (0.0 ; 6.319)

Minimum Fit Function Value = 0.0112  
 Population Discrepancy Function Value (F0) = 0.0  
 90 Percent Confidence Interval for F0 = (0.0 ; 0.0347)  
 Root Mean Square Error of Approximation (RMSEA) = 0.0  
 90 Percent Confidence Interval for RMSEA = (0.0 ; 0.108)  
 P-Value for Test of Close Fit (RMSEA < 0.05) = 0.724

Expected Cross-Validation Index (ECVI) = 0.214  
 90 Percent Confidence Interval for ECVI = (0.214 ; 0.249)  
 ECVI for Saturated Model = 0.231  
 ECVI for Independence Model = 0.847

Chi-Square for Independence Model with 15 Degrees of Freedom = 142.082  
 Independence AIC = 154.082  
 Model AIC = 38.021  
 Saturated AIC = 42.000  
 Independence CAIC = 179.338  
 Model CAIC = 113.792  
 Saturated CAIC = 130.399

Normed Fit Index (NFI) = 0.986  
 Non-Normed Fit Index (NNFI) = 1.038  
 Parsimony Normed Fit Index (PNFI) = 0.197  
 Comparative Fit Index (CFI) = 1.000  
 Incremental Fit Index (IFI) = 1.007  
 Relative Fit Index (RFI) = 0.928

Critical N (CN) = 1017.050

Root Mean Square Residual (RMR) = 0.0129  
Standardized RMR = 0.0129  
Goodness of Fit Index (GFI) = 0.996  
Adjusted Goodness of Fit Index (AGFI) = 0.974  
Parsimony Goodness of Fit Index (PGFI) = 0.142

## LISREL output for Study 1: Model 3

### (11a) Structural model

#### Goodness of Fit Statistics

Degrees of Freedom = 6  
Minimum Fit Function Chi-Square = 34.143 (P = 0.000)  
Normal Theory Weighted Least Squares Chi-Square = 35.490 (P = 0.000)  
Estimated Non-centrality Parameter (NCP) = 29.490  
90 Percent Confidence Interval for NCP = (14.350 ; 52.128)

Minimum Fit Function Value = 0.188  
Population Discrepancy Function Value (F0) = 0.162  
90 Percent Confidence Interval for F0 = (0.0788 ; 0.286)  
Root Mean Square Error of Approximation (RMSEA) = 0.164  
90 Percent Confidence Interval for RMSEA = (0.115 ; 0.218)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.000186

Expected Cross-Validation Index (ECVI) = 0.360  
90 Percent Confidence Interval for ECVI = (0.277 ; 0.484)  
ECVI for Saturated Model = 0.231  
ECVI for Independence Model = 0.782

Chi-Square for Independence Model with 15 Degrees of Freedom = 130.258  
Independence AIC = 142.258  
Model AIC = 65.490  
Saturated AIC = 42.000  
Independence CAIC = 167.515  
Model CAIC = 128.632  
Saturated CAIC = 130.399

Normed Fit Index (NFI) = 0.738  
Non-Normed Fit Index (NNFI) = 0.390  
Parsimony Normed Fit Index (PNFI) = 0.295  
Comparative Fit Index (CFI) = 0.756  
Incremental Fit Index (IFI) = 0.774  
Relative Fit Index (RFI) = 0.345

Critical N (CN) = 90.618

Root Mean Square Residual (RMR) = 0.0969  
Standardized RMR = 0.0969  
Goodness of Fit Index (GFI) = 0.939  
Adjusted Goodness of Fit Index (AGFI) = 0.787  
Parsimony Goodness of Fit Index (PGFI) = 0.268

### (11b) Measurement and structural components

#### Structural Equations

manual = 0.0705\*parent, Errorvar.= 0.995 , R<sup>2</sup> = 0.00497  
(0.0925) (0.131)  
0.762 7.616

aim = 0.0741\*parent, Errorvar.= 0.995 , R<sup>2</sup> = 0.00549  
(0.0925) (0.131)  
0.801 7.615

bal = 0.121\*parent, Errorvar.= 0.985 , R<sup>2</sup> = 0.0146  
(0.0923) (0.130)  
1.308 7.587

$lang = 0.207*manual + 0.00135*aim + 0.110*bal - 0.0585*parent,$   
 Errorvar.= 0.944 , R<sup>2</sup> = 0.0557  
 (0.377)      (0.0988)      (0.0924)      (0.0948)      (0.0943)  
 2.502      2.099      0.0146      1.164      -0.621

**(11c) Correlations between latent variables**

Correlation Matrix of Independent Variables

	parent	manual	aim	bal	lang
parent	1.000				
manual	0.056 (0.092)	1.000			
aim	0.609 0.065 (0.092)	0.325 (0.085)	1.000		
bal	0.704 0.113 (0.092)	3.822 0.396 (0.081)	0.194 (0.090)	1.000	
lang	1.226 -0.033 (0.093)	4.871 0.237 (0.090)	2.154 0.068 (0.093)	0.169 (0.092)	1.000
	-0.357	2.646	0.729	1.841	

**(11d) Measurement model**

Goodness of Fit Statistics

Degrees of Freedom = 3  
 Minimum Fit Function Chi-Square = 1.830 (P = 0.608)  
 Normal Theory Weighted Least Squares Chi-Square = 1.821 (P = 0.610)  
 Estimated Non-centrality Parameter (NCP) = 0.0  
 90 Percent Confidence Interval for NCP = (0.0 ; 5.817)

Minimum Fit Function Value = 0.0101  
 Population Discrepancy Function Value (F0) = 0.0  
 90 Percent Confidence Interval for F0 = (0.0 ; 0.0320)  
 Root Mean Square Error of Approximation (RMSEA) = 0.0  
 90 Percent Confidence Interval for RMSEA = (0.0 ; 0.103)  
 P-Value for Test of Close Fit (RMSEA < 0.05) = 0.756

Expected Cross-Validation Index (ECVI) = 0.214  
 90 Percent Confidence Interval for ECVI = (0.214 ; 0.246)  
 ECVI for Saturated Model = 0.231  
 ECVI for Independence Model = 0.782

Chi-Square for Independence Model with 15 Degrees of Freedom = 130.258  
 Independence AIC = 142.258  
 Model AIC = 37.821  
 Saturated AIC = 42.000  
 Independence CAIC = 167.515  
 Model CAIC = 113.592  
 Saturated CAIC = 130.399

Normed Fit Index (NFI) = 0.986  
 Non-Normed Fit Index (NNFI) = 1.051  
 Parsimony Normed Fit Index (PNFI) = 0.197  
 Comparative Fit Index (CFI) = 1.000  
 Incremental Fit Index (IFI) = 1.009  
 Relative Fit Index (RFI) = 0.930

Critical N (CN) = 1129.444

Root Mean Square Residual (RMR) = 0.0116  
Standardized RMR = 0.0116  
Goodness of Fit Index (GFI) = 0.997  
Adjusted Goodness of Fit Index (AGFI) = 0.977  
Parsimony Goodness of Fit Index (PGFI) = 0.142

## Appendix N

### SPSS and LISREL Outputs for Study 2

(1) Descriptive Statistics for Child's Age, Gender and Grade

#### Statistics

age\_at\_testing

N	Valid	84
	Missing	0
Mean		4.6812
Std. Deviation		.70620
Minimum		4.00
Maximum		6.11

#### sex

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid male	50	59.5	59.5	59.5
female	34	40.5	40.5	100.0
Total	84	100.0	100.0	

#### grade

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Kindy	41	48.8	48.8	48.8
Pre-primary	32	38.1	38.1	86.9
Year 1	11	13.1	13.1	100.0
Total	84	100.0	100.0	

(2) Descriptive Statistics for Mothers and Families Characteristics

**Statistics**

Demographic Questionnaire 2a -

Mother's age

N	Valid	84
	Missing	0
Mean		37.33
Std. Deviation		4.227
Minimum		25
Maximum		45

**Demographic Questionnaire 3 - Mother's marital status**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Single	1	1.2	1.2	1.2
	Married or Defacto	78	92.9	92.9	94.0
	Separated	1	1.2	1.2	95.2
	Divorced	4	4.8	4.8	100.0
	Total	84	100.0	100.0	

**Demographic Questionnaire 5 - Mother's educational level**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	highschool 8-10 years	1	1.2	1.2	1.2
	highschool 11-12 years	4	4.8	4.8	6.0
	apprentice/technical	3	3.6	3.6	9.5
	diploma	3	3.6	3.6	13.1
	university degree	62	73.8	73.8	86.9
	university postgrad	11	13.1	13.1	100.0
	Total	84	100.0	100.0	

**Demographic Questionnaire 6a - Ethnicity**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Australian	65	77.4	77.4	77.4
	north and west European	7	8.3	8.3	85.7
	Southern European	1	1.2	1.2	86.9
	Asian	7	8.3	8.3	95.2
	white SA	4	4.8	4.8	100.0
	Total	84	100.0	100.0	

**Demographic Questionnaire 7 - Family income**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	30,000 and below	2	2.4	2.4	2.4
	30,000 to 49,000	4	4.8	4.8	7.1
	50,000 to 79,999	5	6.0	6.0	13.1
	80,000 and above	72	85.7	85.7	98.8
	Missing	1	1.2	1.2	100.0
	Total	84	100.0	100.0	

**Demographic Questionnaire 4 - Number of children**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	only child	5	6.0	6.0	6.0
	2 children	55	65.5	65.5	71.4
	3 children	16	19.0	19.0	90.5
	more than 3 children	1	1.2	1.2	91.7
	Missing	7	8.3	8.3	100.0
	Total	84	100.0	100.0	

(3) Descriptive Statistics for Key Measures

*Parenting behaviours*

		<b>Statistics</b>			
		MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score
N	Valid	84	84	84	84
	Missing	0	0	0	0
Mean		4.2302	3.7476	3.4940	3.0179
Std. Deviation		.68502	.71008	.75846	.44211
Skewness		-1.075	-.439	-.383	.465
Std. Error of Skewness		.263	.263	.263	.263
Kurtosis		.764	-.872	-.104	1.482
Std. Error of Kurtosis		.520	.520	.520	.520
Minimum		2.33	2.00	1.50	2.00
Maximum		5.00	4.80	5.00	4.50

*Motor*

		<b>Statistics</b>		
		MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score
N	Valid	84	84	84
	Missing	0	0	0
Mean		9.90	9.98	11.61
Std. Deviation		2.873	3.300	3.219
Skewness		-.080	.063	.340
Std. Error of Skewness		.263	.263	.263
Kurtosis		.227	.665	-.770
Std. Error of Kurtosis		.520	.520	.520
Minimum		2	1	5
Maximum		18	19	18

*Language*

**Statistics**

		CEL F - Expressive Language Index - Standard Score	CEL F - Receptive Language Index - Standard Score
N	Valid	84	84
	Missing	0	0
Mean		104.99	103.37
Std. Deviation		13.595	12.262
Skewness		-.690	-.563
Std. Error of Skewness		.263	.263
Kurtosis		2.013	.459
Std. Error of Kurtosis		.520	.520
Minimum		61	66
Maximum		140	128

*IQ*

**Statistics**

		W P S S I - I I I V e b a l I Q - C o m p o s i t e S c o r e	W P S S I - I I I P e r f o r m a n c e I Q - C o m p o s i t e S c o r e
N	Valid	84	84
	Missing	0	0
Mean		109.17	99.88
Std. Deviation		13.332	14.650
Minimum		72	73
Maximum		141	132

*Interrater Reliability*

(4a) Responsiveness subscale

**Reliability Statistics**

Cronbach's Alpha	N of Items
.960	4

**Intraclass Correlation Coefficient**

	Intraclass Correlation <sup>a</sup>	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.858 <sup>b</sup>	.747	.934	25.168	19	57	.000
Average Measures	.960 <sup>c</sup>	.922	.983	25.168	19	57	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

- a. Type A intraclass correlation coefficients using an absolute agreement definition.
- b. The estimator is the same, whether the interaction effect is present or not.
- c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

(4b) Affect subscale

**Reliability Statistics**

Cronbach's Alpha	N of Items
.964	4

**Intraclass Correlation Coefficient**

	Intraclass Correlation <sup>a</sup>	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.864 <sup>b</sup>	.757	.937	27.881	19	57	.000
Average Measures	.962 <sup>c</sup>	.926	.983	27.881	19	57	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

- a. Type A intraclass correlation coefficients using an absolute agreement definition.
- b. The estimator is the same, whether the interaction effect is present or not.
- c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

(4c) Achievement Orientation subscale

**Reliability Statistics**

Cronbach's Alpha	N of Items
.910	4

**Intraclass Correlation Coefficient**

	Intraclass Correlation <sup>a</sup>	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.721 <sup>b</sup>	.543	.861	11.103	19	57	.000
Average Measures	.912 <sup>c</sup>	.826	.961	11.103	19	57	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. Type A intraclass correlation coefficients using an absolute agreement definition.

b. The estimator is the same, whether the interaction effect is present or not.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

(4d) Directiveness subscale

**Reliability Statistics**

Cronbach's Alpha	N of Items
.918	4

**Intraclass Correlation Coefficient**

	Intraclass Correlation <sup>a</sup>	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	.742 <sup>b</sup>	.572	.873	12.147	19	57	.000
Average Measures	.920 <sup>c</sup>	.842	.965	12.147	19	57	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

- a. Type A intraclass correlation coefficients using an absolute agreement definition.
- b. The estimator is the same, whether the interaction effect is present or not.
- c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

*Difference between Raters on MBRS-R*

(5a) Responsiveness subscale

**Multivariate Tests<sup>b</sup>**

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
RATERS Pillai's Trace	.019	.110 <sup>a</sup>	3.000	17.000	.953	.019
Wilks' Lambda	.981	.110 <sup>a</sup>	3.000	17.000	.953	.019
Hotelling's Trace	.019	.110 <sup>a</sup>	3.000	17.000	.953	.019
Roy's Largest Root	.019	.110 <sup>a</sup>	3.000	17.000	.953	.019

a. Exact statistic

b. Design: Intercept

Within Subjects Design: RATERS

(5b) Affect subscale

Multivariate Tests<sup>b</sup>

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
RATERS Pillai's Trace	.034	.198 <sup>a</sup>	3.000	17.000	.896	.034
Wilks' Lambda	.966	.198 <sup>a</sup>	3.000	17.000	.896	.034
Hotelling's Trace	.035	.198 <sup>a</sup>	3.000	17.000	.896	.034
Roy's Largest Root	.035	.198 <sup>a</sup>	3.000	17.000	.896	.034

a. Exact statistic

b. Design: Intercept

Within Subjects Design: RATERS

(5c) Achievement Orientation subscale

**Multivariate Tests<sup>b</sup>**

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
RATERS Pillai's Trace	.092	.576 <sup>a</sup>	3.000	17.000	.639	.092
Wilks' Lambda	.908	.576 <sup>a</sup>	3.000	17.000	.639	.092
Hotelling's Trace	.102	.576 <sup>a</sup>	3.000	17.000	.639	.092
Roy's Largest Root	.102	.576 <sup>a</sup>	3.000	17.000	.639	.092

a. Exact statistic

b. Design: Intercept

Within Subjects Design: RATERS

(5d) Directiveness subscale

Multivariate Tests<sup>b</sup>

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
RATERS Pillai's Trace	.109	.693 <sup>a</sup>	3.000	17.000	.569	.109
Wilks' Lambda	.891	.693 <sup>a</sup>	3.000	17.000	.569	.109
Hotelling's Trace	.122	.693 <sup>a</sup>	3.000	17.000	.569	.109
Roy's Largest Root	.122	.693 <sup>a</sup>	3.000	17.000	.569	.109

a. Exact statistic

b. Design: Intercept

Within Subjects Design: RATERS

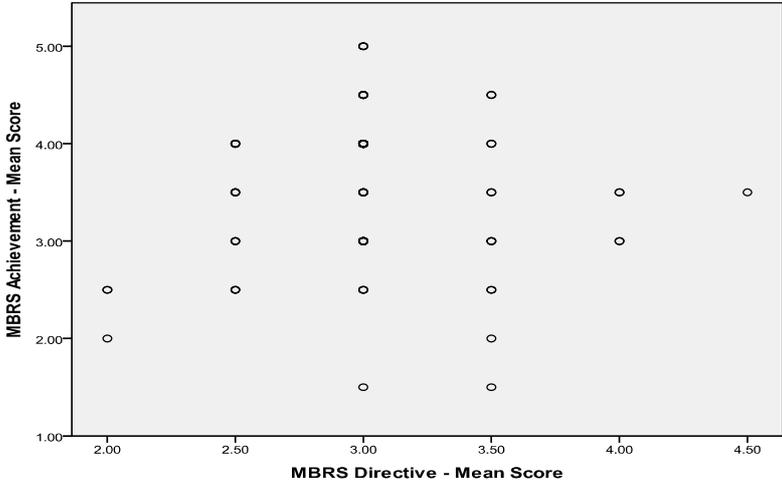
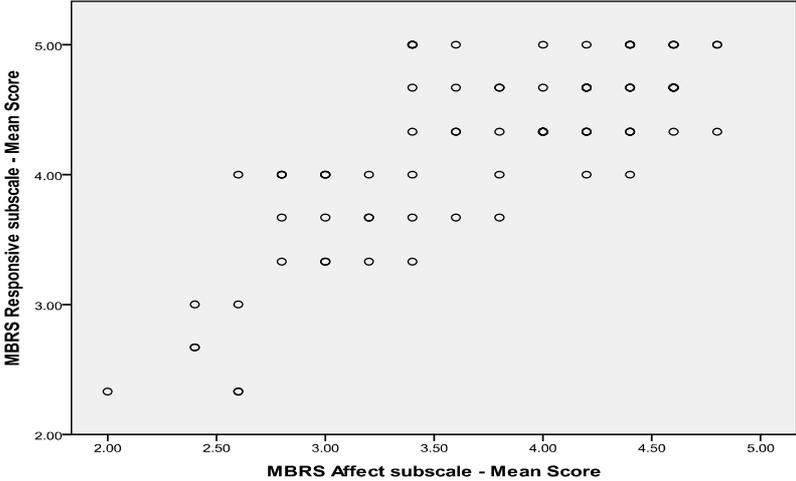
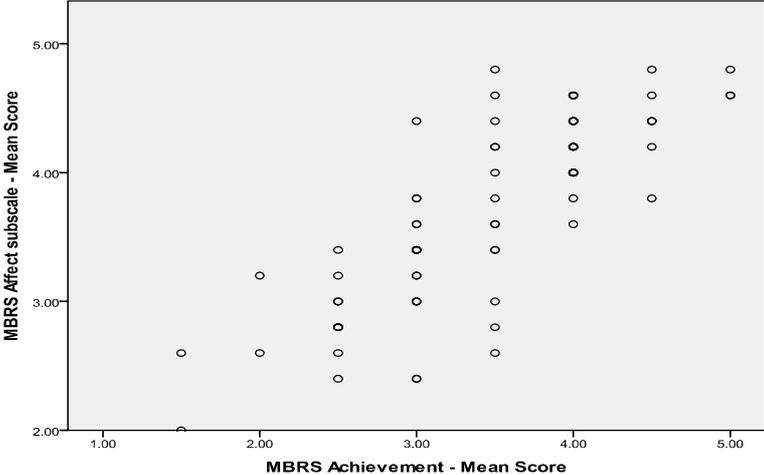
(6) Correlations among Indicators: Pearson Correlations above Diagonal, Spearman Correlations below Diagonal ( $N = 84$ )

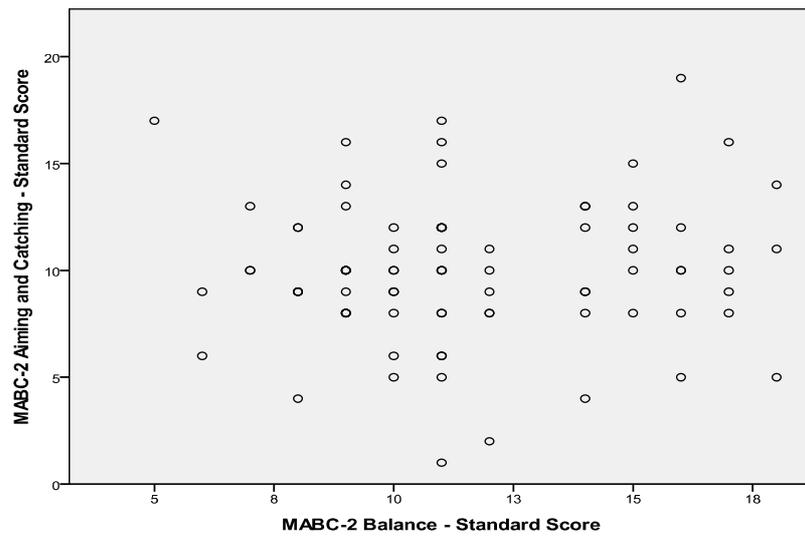
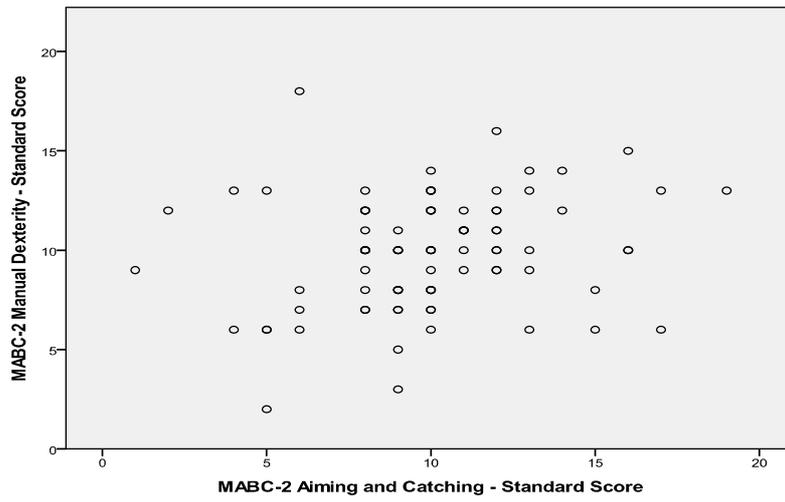
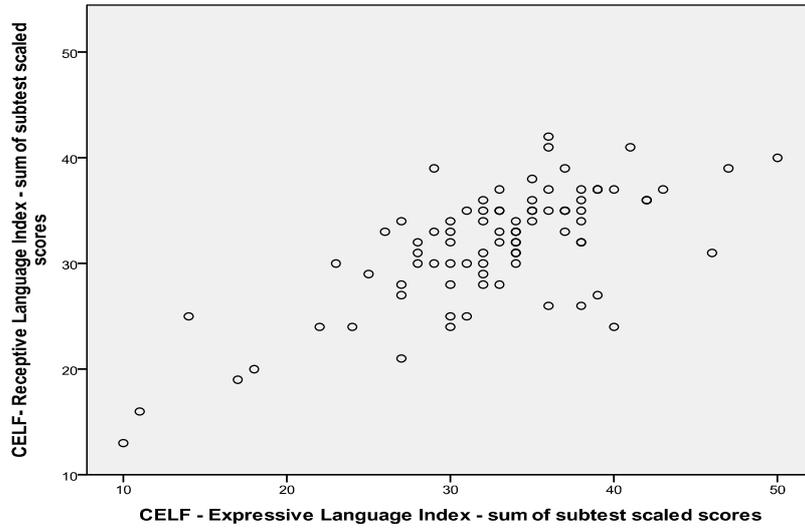
	MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score	CELF- Receptive Language Index - sum of subtest scaled scores	CELF - Expressive Language Index - sum of subtest scaled scores
MBRS Responsive subscale - Mean Score	1	<b>.762**</b>	<b>.691**</b>	.080	<b>.304**</b>	.002	<b>.336**</b>	<b>.637**</b>	<b>.599**</b>
MBRS Affect subscale - Mean Score	<b>.696**</b>	1	<b>.811**</b>	-.051	<b>.244*</b>	.165	.199	<b>.564**</b>	<b>.475**</b>
MBRS Achievement - Mean Score	<b>.596**</b>	<b>.803**</b>	1	.054	<b>.373**</b>	.144	.167	<b>.602**</b>	<b>.591**</b>
MBRS Directive - Mean Score	.021	-.034	.041	1	.182	-.008	.094	.053	.012
MABC-2 Manual Dexterity - Standard Score	<b>.251*</b>	<b>.221*</b>	<b>.363**</b>	.148	1	.214	<b>.254*</b>	<b>.344**</b>	<b>.231*</b>
MABC-2 Aiming and Catching - Standard Score	.003	.164	.129	.016	<b>.294*</b>	1	.058	.053	-.056
MABC-2 Balance - Standard Score	<b>.291**</b>	.147	.152	.042	<b>.273*</b>	.059	1	<b>.240*</b>	<b>.245*</b>
CELF- Receptive Language Index - sum of subtest scaled scores	<b>.455**</b>	<b>.459**</b>	<b>.522**</b>	.046	<b>.319**</b>	.065	.195	1	<b>.703**</b>
CELF - Expressive Language Index - sum of subtest scaled scores	<b>.488**</b>	<b>.423**</b>	<b>.516**</b>	.010	.184	-.021	.192	<b>.603**</b>	1

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

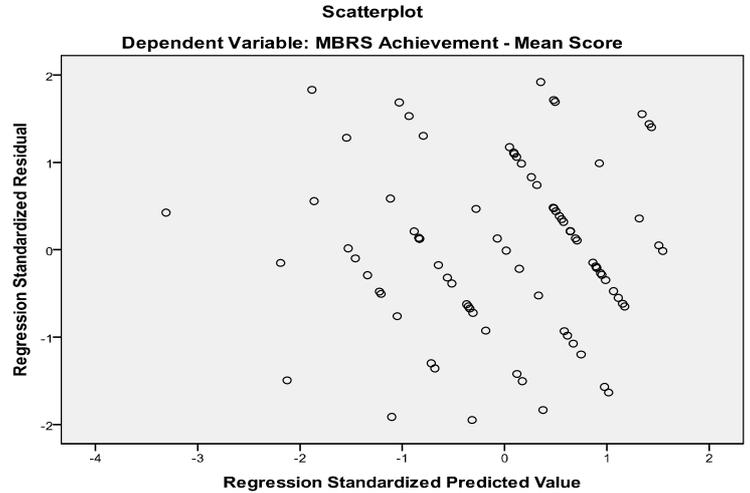
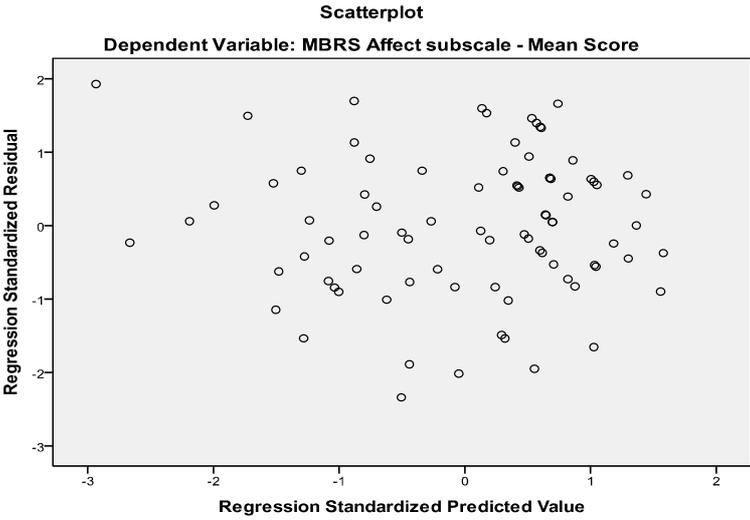
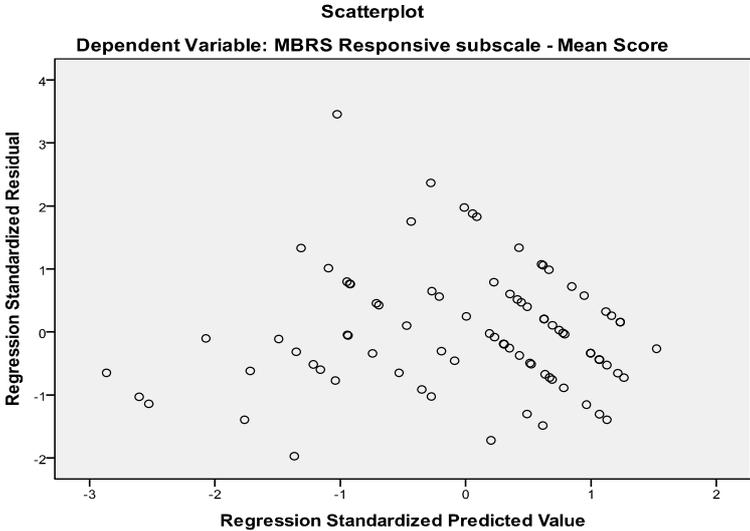
\* . Correlation is significant at the 0.05 level (2-tailed).

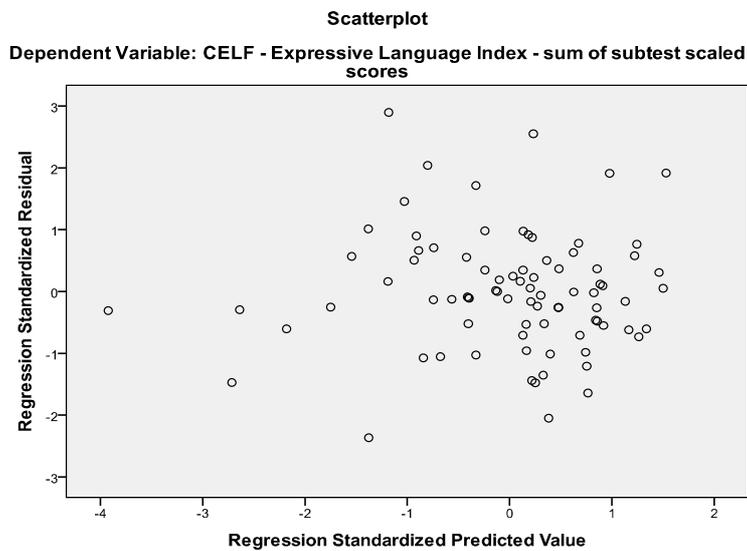
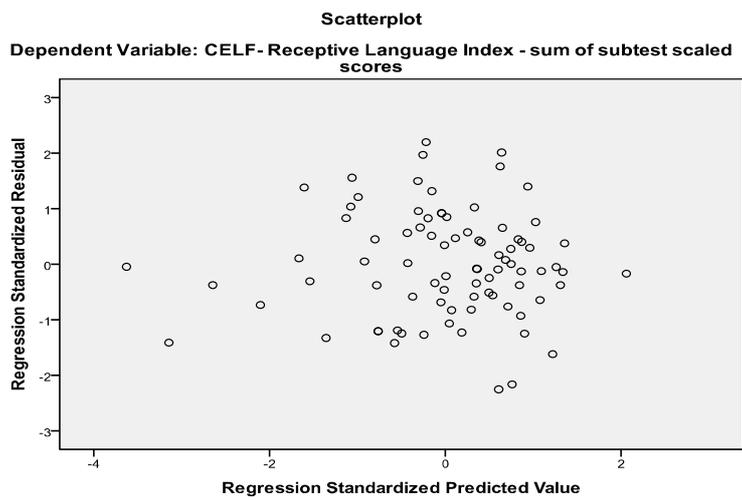
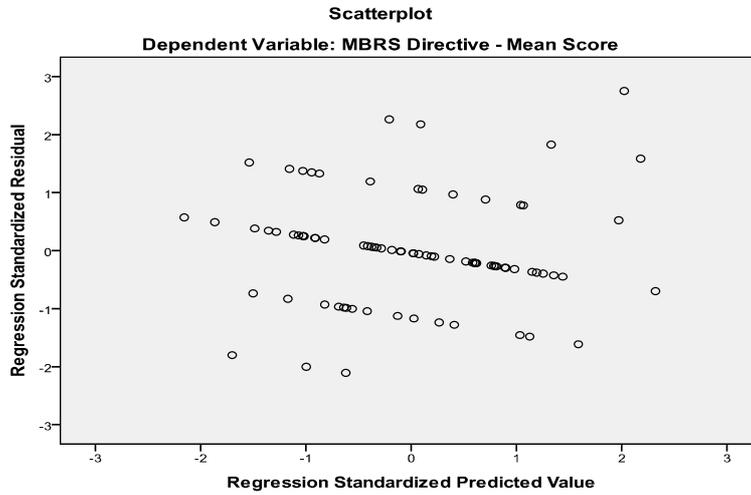
(7) Scatterplots for Key Variables: Assumption of Linearity (Samples)

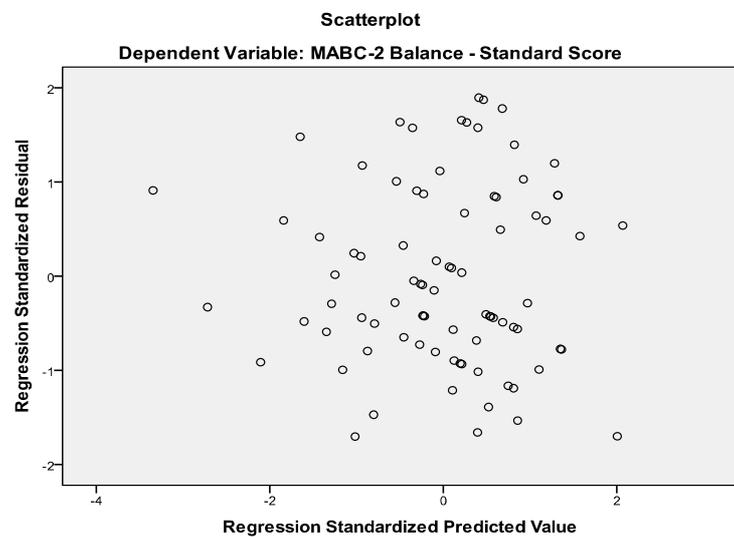
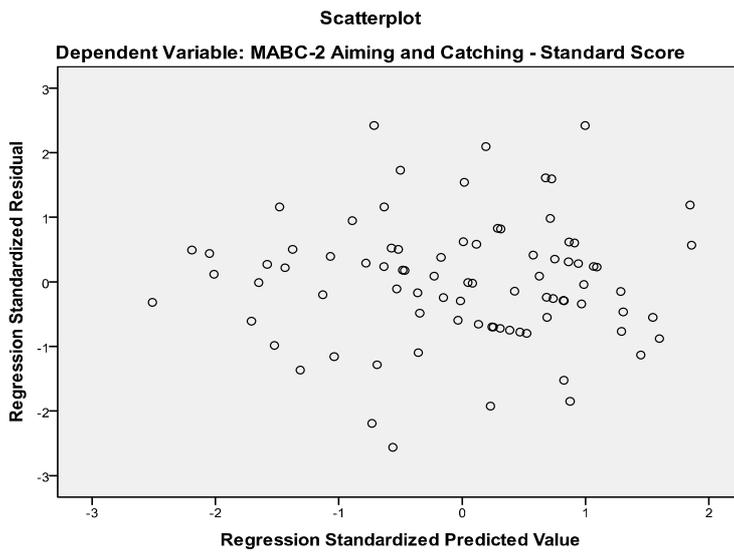
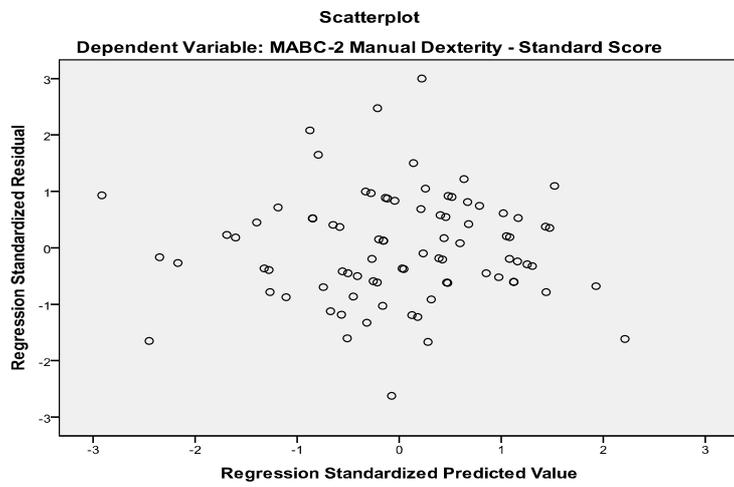




(8) Scatterplots for Key Variables: Assumption of Homoscedasticity (Samples)







(4) Pearson's Correlation for Potential Confounding Variables

	MBRS Respon sive sub scale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achieveme nt - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score	CELF- Receptive Language Index - sum of subtest scaled scores	CELF - Expressive Language Index - sum of subtest scaled scores
sex	.173	.199	.119	-.089	.078	.102	.094	.158	.075
age_at_testing	-.173	-.078	-.042	-.007	-.076	.051	-.172	<b>-.221*</b>	<b>-.293**</b>
Demographic Questionnaire 2a - Mother's age	<b>.324**</b>	<b>.243*</b>	.183	-.032	<b>.222*</b>	.052	.174	<b>.393**</b>	<b>.324**</b>
Demographic Questionnaire 5 - Mother's educational level	<b>.225*</b>	<b>.239*</b>	<b>.215*</b>	.121	-.006	.045	.127	.054	.103
Demographic Questionnaire 7 - Family income	.164	.109	.202	-.007	.002	.070	.141	.212	<b>.272*</b>
Ethnic_Group	<b>-.322**</b>	<b>-.307**</b>	<b>-.317**</b>	.108	-.181	.134	-.094	-.213	<b>-.323**</b>
WPSSI-III Verbal IQ - Scaled Score	<b>.531**</b>	<b>.401**</b>	<b>.402**</b>	.142	.185	.104	.092	<b>.525**</b>	<b>.465**</b>
WPSSI-III Performance IQ - Scaled Score	<b>.223*</b>	<b>.223*</b>	.156	.208	.136	.160	-.032	<b>.340**</b>	.061

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

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

(5) Pearson's Correlation for Key Measures

	MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score	CELF- Receptive Language Index - sum of subtest scaled scores	CELF - Expressive Language Index - sum of subtest scaled scores
MBRS Responsive subscale - Mean Score	1	<b>.762**</b>	<b>.691**</b>	.080	<b>.304**</b>	.002	<b>.336**</b>	<b>.637**</b>	<b>.599**</b>
MBRS Affect subscale - Mean Score	<b>.688**</b>	1	<b>.811**</b>	-.051	<b>.244*</b>	.165	.199	<b>.564**</b>	<b>.475**</b>
MBRS Achievement - Mean Score	<b>.594**</b>	<b>.765**</b>	1	.054	<b>.373**</b>	.144	.167	<b>.602**</b>	<b>.591**</b>
MBRS Directive - Mean Score	.058	-.091	.043	1	.182	-.008	.094	.053	.012
MABC-2 Manual Dexterity - Standard Score	.200	.143	<b>.310**</b>	.187	1	.214	<b>.254*</b>	<b>.344**</b>	<b>.231*</b>
MABC-2 Aiming and Catching - Standard Score	-.032	.172	.164	-.064	.217	1	.058	.053	-.056
MABC-2 Balance - Standard Score	<b>.312**</b>	.156	.121	.117	<b>.223*</b>	.065	1	<b>.240*</b>	<b>.245*</b>
CELF- Receptive Language Index - sum of subtest scaled scores	<b>.470**</b>	<b>.429**</b>	<b>.512**</b>	-.014	<b>.246*</b>	-.015	.200	1	<b>.703**</b>
CELF - Expressive Language Index - sum of subtest scaled scores	<b>.415**</b>	<b>.320**</b>	<b>.471**</b>	.015	<b>.220*</b>	-.074	.181	<b>.627**</b>	1

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

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

## LISREL output for Study 2: Model 1

### (11a) Structural model

#### Goodness of Fit Statistics

Degrees of Freedom = 7  
Minimum Fit Function Chi-Square = 16.980 (P = 0.0175)  
Normal Theory Weighted Least Squares Chi-Square = 14.357 (P = 0.0452)  
Estimated Non-centrality Parameter (NCP) = 7.357  
90 Percent Confidence Interval for NCP = (0.145 ; 22.267)

Minimum Fit Function Value = 0.202  
Population Discrepancy Function Value (F0) = 0.0876  
90 Percent Confidence Interval for F0 = (0.00173 ; 0.265)  
Root Mean Square Error of Approximation (RMSEA) = 0.112  
90 Percent Confidence Interval for RMSEA = (0.0157 ; 0.195)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.103

Expected Cross-Validation Index (ECVI) = 0.504  
90 Percent Confidence Interval for ECVI = (0.418 ; 0.682)  
ECVI for Saturated Model = 0.500  
ECVI for Independence Model = 3.376

Chi-Square for Independence Model with 15 Degrees of Freedom = 271.618  
Independence AIC = 283.618  
Model AIC = 42.357  
Saturated AIC = 42.000  
Independence CAIC = 304.274  
Model CAIC = 90.554  
Saturated CAIC = 114.296

Normed Fit Index (NFI) = 0.937  
Non-Normed Fit Index (NNFI) = 0.917  
Parsimony Normed Fit Index (PNFI) = 0.437  
Comparative Fit Index (CFI) = 0.961  
Incremental Fit Index (IFI) = 0.962  
Relative Fit Index (RFI) = 0.866

Critical N (CN) = 92.399

Root Mean Square Residual (RMR) = 0.0455  
Standardized RMR = 0.0455  
Goodness of Fit Index (GFI) = 0.946  
Adjusted Goodness of Fit Index (AGFI) = 0.838  
Parsimony Goodness of Fit Index (PGFI) = 0.315

The Modification Indices Suggest to Add an Error Covariance  
Between and Decrease in Chi-Square New Estimate  
ParACH ParRES 10.0 -0.26

### (11b) Measurement and structural components

#### Structural Equations

MD = 0.285\*PARENT, Errorvar.= 0.919 , R<sup>2</sup> = 0.0813  
(0.127) (0.182)  
2.237 5.048

LANG = 0.155\*MD + 0.597\*PARENT, Errorvar.= 0.567 , R<sup>2</sup> = 0.433  
(0.121) (0.126) (0.187)  
1.281 4.741 3.027

Reduced Form Equations

MD = 0.285\*PARENT, Errorvar.= 0.919, R<sup>2</sup> = 0.0813  
(0.127)  
2.237

LANG = 0.641\*PARENT, Errorvar.= 0.589, R<sup>2</sup> = 0.411  
(0.123)  
5.206

Correlation Matrix of Independent Variables

PARENT  
-----  
1.000

**(11c) Correlations between Latent Variables**

Covariance Matrix of Latent Variables

	MD	LANG	PARENT
MD	1.000		
LANG	0.325	1.000	
PARENT	0.285	0.641	1.000

**(11d) Measurement model**

Goodness of Fit Statistics

Degrees of Freedom = 7  
Minimum Fit Function Chi-Square = 16.980 (P = 0.0175)  
Normal Theory Weighted Least Squares Chi-Square = 14.357 (P = 0.0452)  
Estimated Non-centrality Parameter (NCP) = 7.357  
90 Percent Confidence Interval for NCP = (0.145 ; 22.267)

Minimum Fit Function Value = 0.202  
Population Discrepancy Function Value (F0) = 0.0876  
90 Percent Confidence Interval for F0 = (0.00173 ; 0.265)  
Root Mean Square Error of Approximation (RMSEA) = 0.112  
90 Percent Confidence Interval for RMSEA = (0.0157 ; 0.195)  
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.103

Expected Cross-Validation Index (ECVI) = 0.504  
90 Percent Confidence Interval for ECVI = (0.418 ; 0.682)  
ECVI for Saturated Model = 0.500  
ECVI for Independence Model = 3.376

Chi-Square for Independence Model with 15 Degrees of Freedom = 271.618  
Independence AIC = 283.618  
Model AIC = 42.357  
Saturated AIC = 42.000  
Independence CAIC = 304.274  
Model CAIC = 90.554  
Saturated CAIC = 114.296

Normed Fit Index (NFI) = 0.937  
Non-Normed Fit Index (NNFI) = 0.917  
Parsimony Normed Fit Index (PNFI) = 0.437  
Comparative Fit Index (CFI) = 0.961  
Incremental Fit Index (IFI) = 0.962  
Relative Fit Index (RFI) = 0.866

Critical N (CN) = 92.399

Root Mean Square Residual (RMR) = 0.0455  
Standardized RMR = 0.0455  
Goodness of Fit Index (GFI) = 0.946  
Adjusted Goodness of Fit Index (AGFI) = 0.838  
Parsimony Goodness of Fit Index (PGFI) = 0.315

## LISREL output for Study 2: Model 2

### (12a) Structural model

Goodness of Fit Statistics

Degrees of Freedom = 2

Minimum Fit Function Chi-Square = 0.163 (P = 0.922)

Normal Theory Weighted Least Squares Chi-Square = 0.163 (P = 0.922)

Estimated Non-centrality Parameter (NCP) = 0.0

90 Percent Confidence Interval for NCP = (0.0 ; 0.936)

Minimum Fit Function Value = 0.00194

Population Discrepancy Function Value (F0) = 0.0

90 Percent Confidence Interval for F0 = (0.0 ; 0.0111)

Root Mean Square Error of Approximation (RMSEA) = 0.0

90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0746)

P-Value for Test of Close Fit (RMSEA < 0.05) = 0.936

Expected Cross-Validation Index (ECVI) = 0.214

90 Percent Confidence Interval for ECVI = (0.214 ; 0.225)

ECVI for Saturated Model = 0.238

ECVI for Independence Model = 0.633

Chi-Square for Independence Model with 6 Degrees of Freedom = 45.145

Independence AIC = 53.145

Model AIC = 16.163

Saturated AIC = 20.000

Independence CAIC = 66.915

Model CAIC = 43.704

Saturated CAIC = 54.427

Normed Fit Index (NFI) = 0.996

Non-Normed Fit Index (NNFI) = 1.141

Parsimony Normed Fit Index (PNFI) = 0.332

Comparative Fit Index (CFI) = 1.000

Incremental Fit Index (IFI) = 1.043

Relative Fit Index (RFI) = 0.989

Critical N (CN) = 4756.524

Root Mean Square Residual (RMR) = 0.00992

Standardized RMR = 0.00992

Goodness of Fit Index (GFI) = 0.999

Adjusted Goodness of Fit Index (AGFI) = 0.995

Parsimony Goodness of Fit Index (PGFI) = 0.200

### (12b) Measurement and structural components

#### Structural Equations

MD = 0.234\*PARENT, Errorvar.= 0.945 , R<sup>2</sup> = 0.0546  
(0.135) (0.187)  
1.736 5.067

LANG = 0.337\*MD - 0.0881\*PARENT, Errorvar.= 0.893 , R<sup>2</sup> = 0.107  
(0.135) (0.135) (0.180)  
2.488 -0.654 4.964

#### Reduced Form Equations

MD = 0.234\*PARENT, Errorvar.= 0.945, R<sup>2</sup> = 0.0546  
(0.135)  
1.736

LANG = - 0.00939\*PARENT, Errorvar.= 1.00, R<sup>2</sup> = 0.000  
 (0.134)  
 -0.0702

### (12c) Correlations between Latent Variables

Covariance Matrix of Latent Variables

	MD	LANG	PARENT
MD	1.000		
LANG	0.316	1.000	
PARENT	0.274	-0.009	1.000

### (12d) Measurement model

Goodness of Fit Statistics

Degrees of Freedom = 2  
 Minimum Fit Function Chi-Square = 0.163 (P = 0.922)  
 Normal Theory Weighted Least Squares Chi-Square = 0.163 (P = 0.922)  
 Estimated Non-centrality Parameter (NCP) = 0.0  
 90 Percent Confidence Interval for NCP = (0.0 ; 0.936)

Minimum Fit Function Value = 0.00194  
 Population Discrepancy Function Value (F0) = 0.0  
 90 Percent Confidence Interval for F0 = (0.0 ; 0.0111)  
 Root Mean Square Error of Approximation (RMSEA) = 0.0  
 90 Percent Confidence Interval for RMSEA = (0.0 ; 0.0746)  
 P-Value for Test of Close Fit (RMSEA < 0.05) = 0.936

Expected Cross-Validation Index (ECVI) = 0.214  
 90 Percent Confidence Interval for ECVI = (0.214 ; 0.225)  
 ECVI for Saturated Model = 0.238  
 ECVI for Independence Model = 0.633

Chi-Square for Independence Model with 6 Degrees of Freedom = 45.145  
 Independence AIC = 53.145  
 Model AIC = 16.163  
 Saturated AIC = 20.000  
 Independence CAIC = 66.915  
 Model CAIC = 43.704  
 Saturated CAIC = 54.427

Normed Fit Index (NFI) = 0.996  
 Non-Normed Fit Index (NNFI) = 1.141  
 Parsimony Normed Fit Index (PNFI) = 0.332  
 Comparative Fit Index (CFI) = 1.000  
 Incremental Fit Index (IFI) = 1.043  
 Relative Fit Index (RFI) = 0.989

Critical N (CN) = 4756.524

Root Mean Square Residual (RMR) = 0.00992  
 Standardized RMR = 0.00992  
 Goodness of Fit Index (GFI) = 0.999  
 Adjusted Goodness of Fit Index (AGFI) = 0.995  
 Parsimony Goodness of Fit Index (PGFI) = 0.200

## Appendix O

### SPSS Outputs for Study 3

(1) Descriptive Statistics for Key Measures: PBDQ and MBRS-R

		<b>Statistics</b>				
		PBDQ Emotional Warmth subscale - Mean Score	PBDQ Punitive Discipline subscale - Mean Score (reversed score)	PBDQ Autonomy Support subscale - Mean Score	PBDQ Permissive Discipline subscale - Mean Score	PBDQ Democratic Discipline subscale - Mean Score
N	Valid	84	84	84	84	84
	Missing	23	23	23	23	23
	Mean	5.5337	4.8453	5.0500	5.3167	4.2742
	Std. Deviation	.32076	.47475	.51285	.50749	.51193
	Skewness	-.388	-.243	-1.524	-.782	-.080
	Std. Error of Skewness	.263	.263	.263	.263	.263
	Kurtosis	-.693	.089	5.007	.751	-.446
	Std. Error of Kurtosis	.520	.520	.520	.520	.520
	Minimum	4.67	3.67	3.00	3.60	3.00
	Maximum	6.00	6.00	6.00	6.00	5.33

**Statistics**

		MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score
N	Valid	84	84	84	84
	Missing	23	23	23	23
Mean		4.2302	3.7476	3.4940	3.0179
Std. Deviation		.68502	.71008	.75846	.44211
Skewness		-1.075	-.439	-.383	.465
Std. Error of Skewness		.263	.263	.263	.263
Kurtosis		.764	-.872	-.104	1.482
Std. Error of Kurtosis		.520	.520	.520	.520
Minimum		2.33	2.00	1.50	2.00
Maximum		5.00	4.80	5.00	4.50

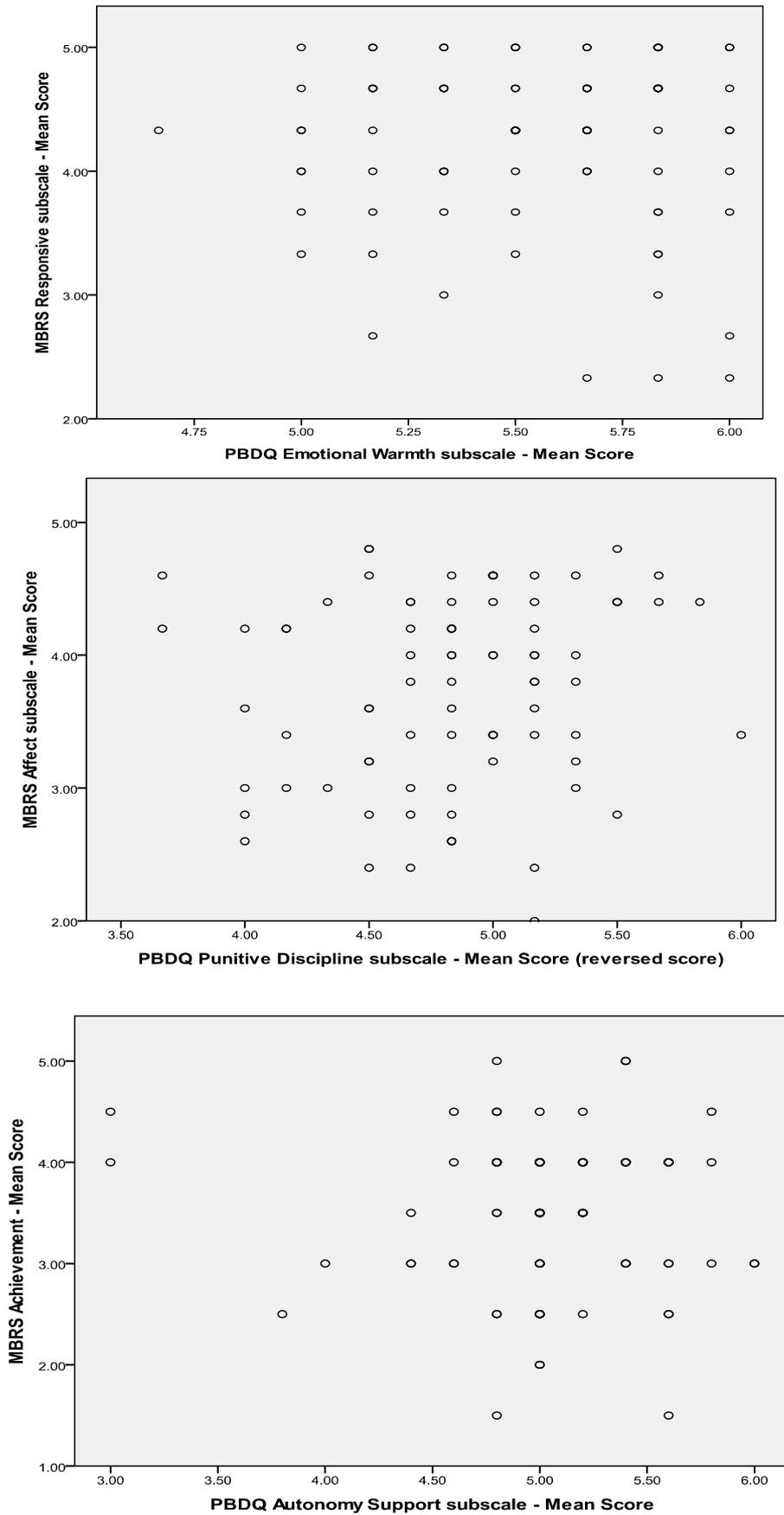
(2) Correlations among Indicators: Pearson Correlations above Diagonal, Spearman Correlations below Diagonal ( $N = 84$ )

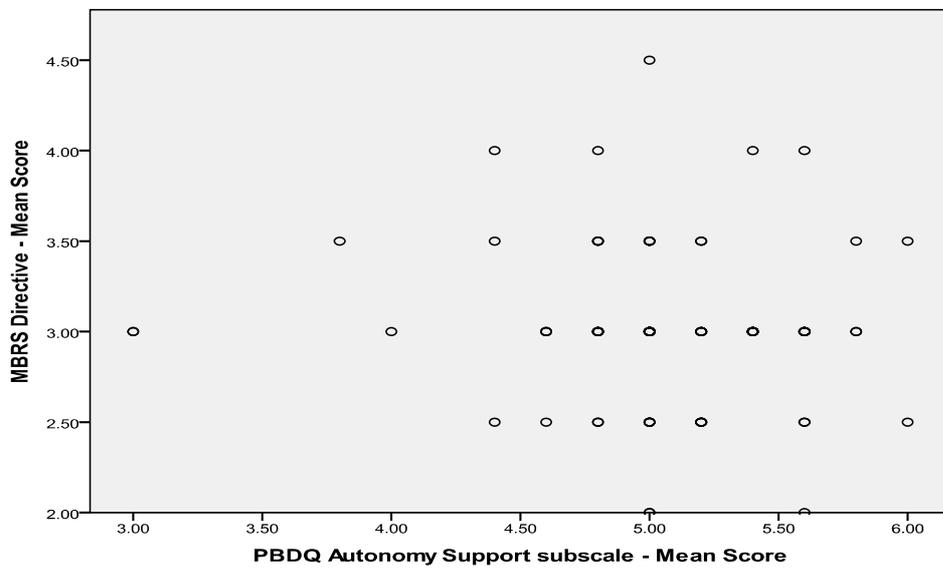
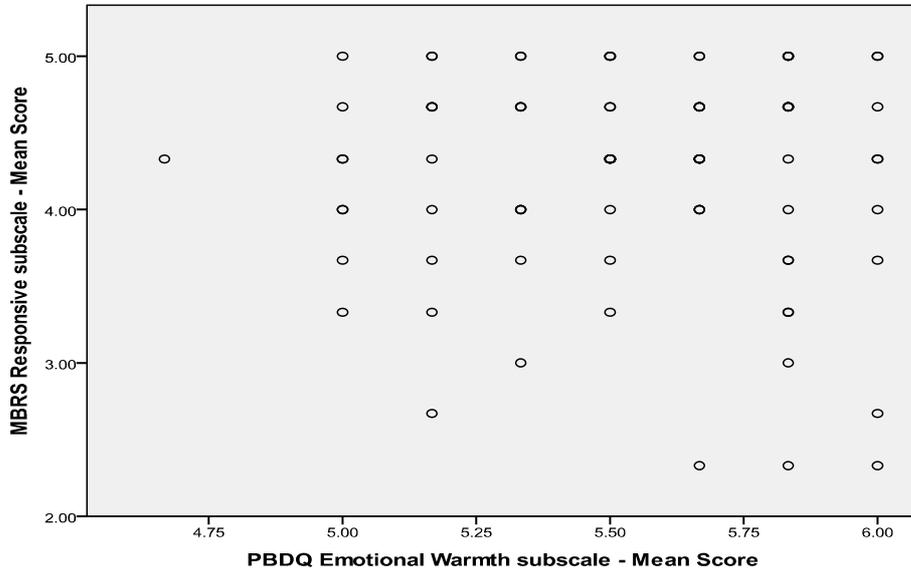
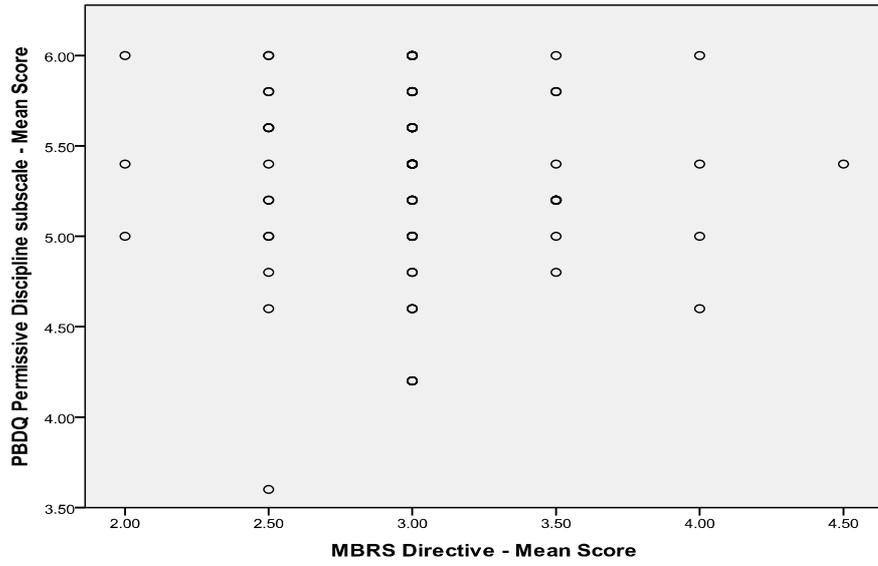
	MBRS Responsive subscale - Mean Score	MBRS Affect subscale - Mean Score	MBRS Achievement - Mean Score	MBRS Directive - Mean Score	MABC-2 Manual Dexterity - Standard Score	MABC-2 Aiming and Catching - Standard Score	MABC-2 Balance - Standard Score	CELF- Receptive Language Index - sum of subtest scaled scores	CELF - Expressive Language Index - sum of subtest scaled scores
MBRS Responsive subscale - Mean Score	1	<b>.762**</b>	<b>.691**</b>	.080	<b>.304**</b>	.002	<b>.336**</b>	<b>.637**</b>	<b>.599**</b>
MBRS Affect subscale - Mean Score	<b>.696**</b>	1	<b>.811**</b>	-.051	<b>.244*</b>	.165	.199	<b>.564**</b>	<b>.475**</b>
MBRS Achievement - Mean Score	<b>.596**</b>	<b>.803**</b>	1	.054	<b>.373**</b>	.144	.167	<b>.602**</b>	<b>.591**</b>
MBRS Directive - Mean Score	.021	-.034	.041	1	.182	-.008	.094	.053	.012
MABC-2 Manual Dexterity - Standard Score	<b>.251*</b>	<b>.221*</b>	<b>.363**</b>	.148	1	.214	<b>.254*</b>	<b>.344**</b>	<b>.231*</b>
MABC-2 Aiming and Catching - Standard Score	.003	.164	.129	.016	<b>.294*</b>	1	.058	.053	-.056
MABC-2 Balance - Standard Score	<b>.291**</b>	.147	.152	.042	<b>.273*</b>	.059	1	<b>.240*</b>	<b>.245*</b>
CELF- Receptive Language Index - sum of subtest scaled scores	<b>.455**</b>	<b>.459**</b>	<b>.522**</b>	.046	<b>.319**</b>	.065	.195	1	<b>.703**</b>
CELF - Expressive Language Index - sum of subtest scaled scores	<b>.488**</b>	<b>.423**</b>	<b>.516**</b>	.010	.184	-.021	.192	<b>.603**</b>	1

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

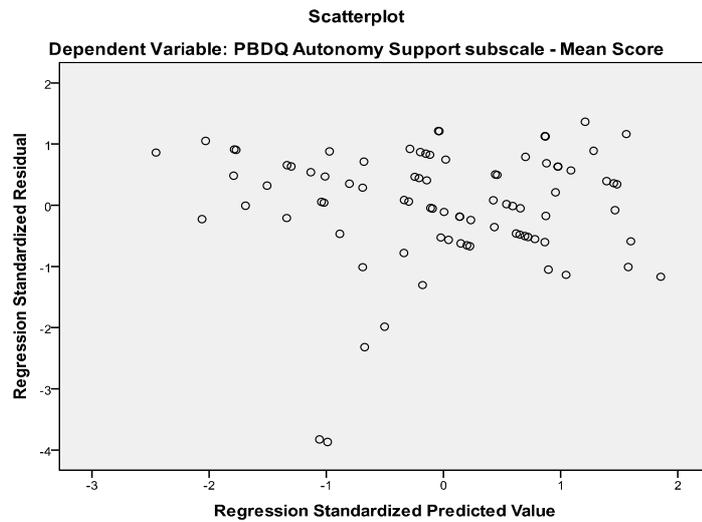
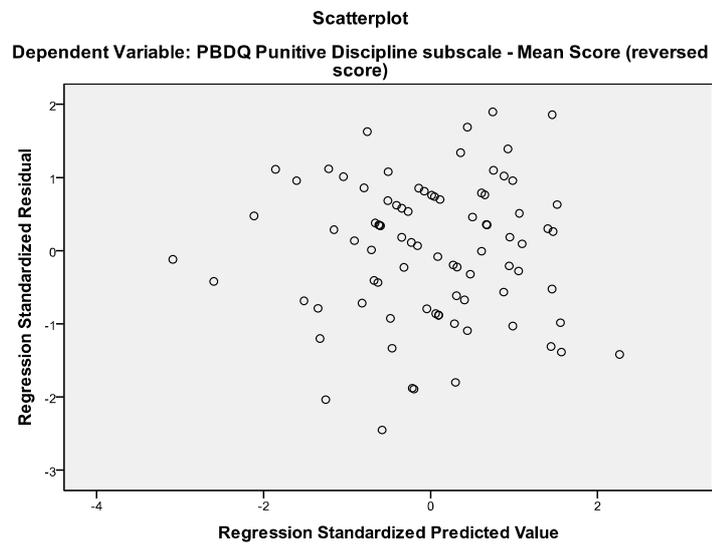
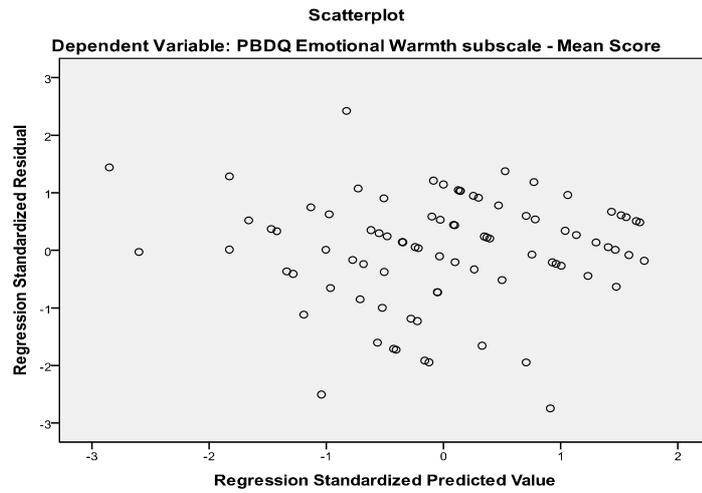
\* . Correlation is significant at the 0.05 level (2-tailed).

(3) Scatterplots for Key Variables: Assumption of Linearity (Samples)

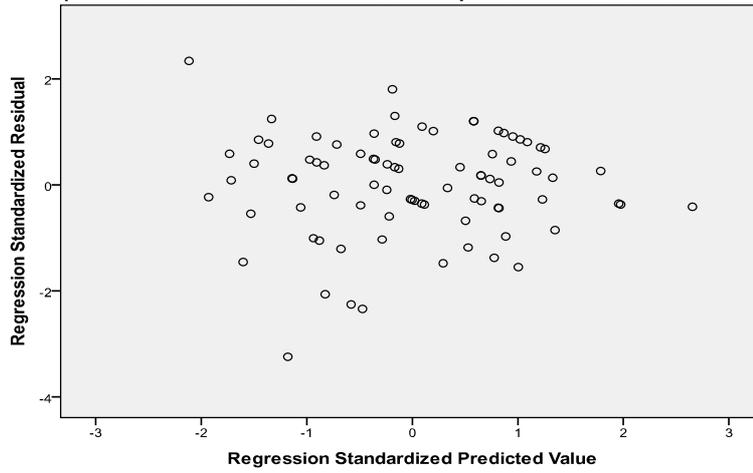




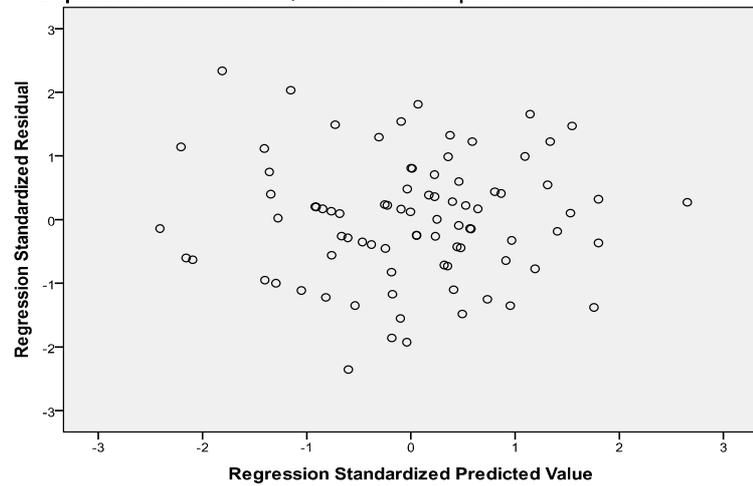
(4) Scatterplots for Key Variables: Assumption of Homoscedasticity (Samples)



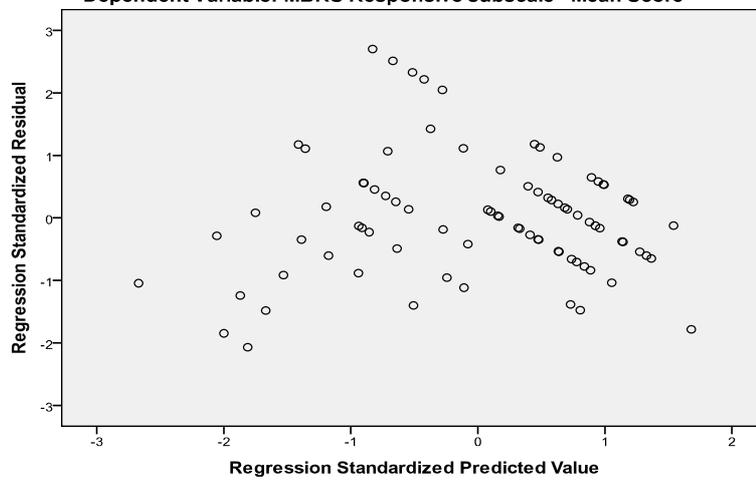
**Scatterplot**  
**Dependent Variable: PBDQ Permissive Discipline subscale - Mean Score**

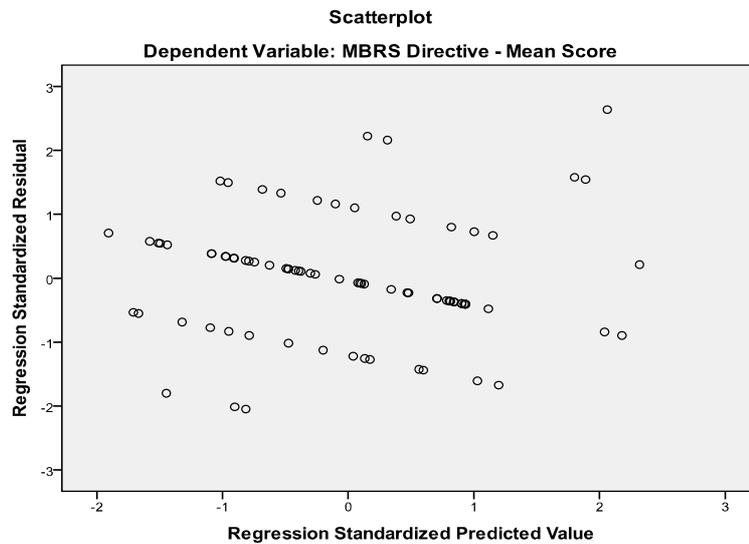
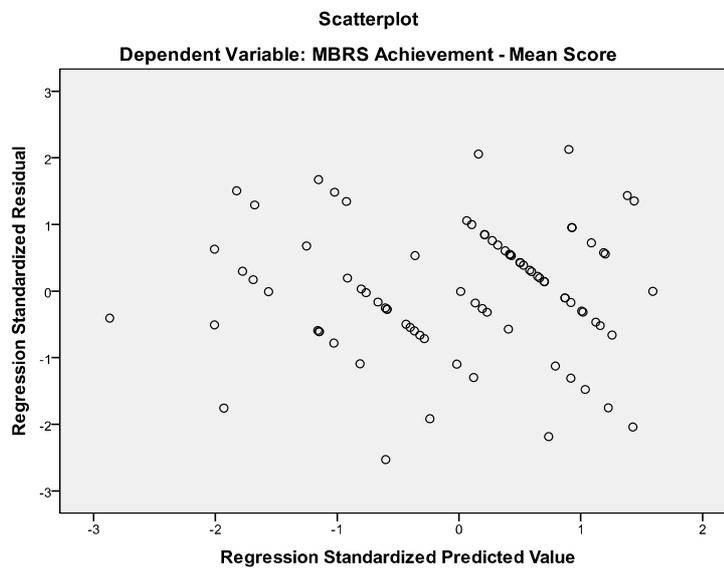
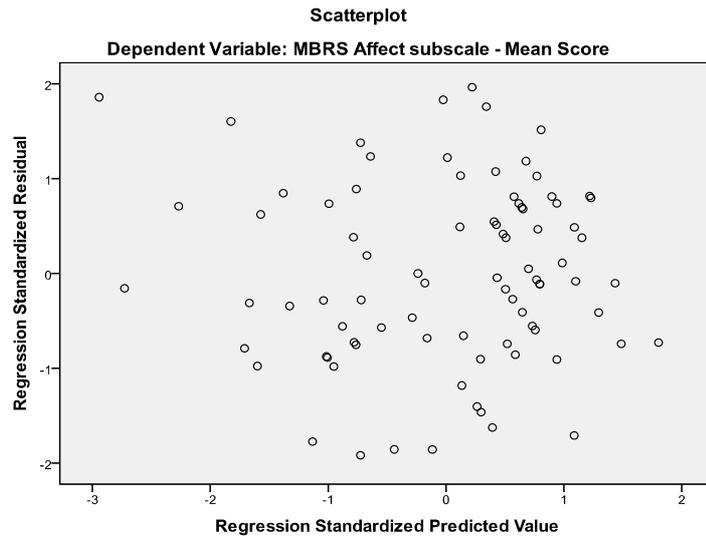


**Scatterplot**  
**Dependent Variable: PBDQ Democratic Discipline subscale - Mean Score**



**Scatterplot**  
**Dependent Variable: MBRs Responsive subscale - Mean Score**





(5) Canonical correlation

-----  
 The default error term in MANOVA has been changed from WITHIN CELLS to  
 WITHIN+RESIDUAL. Note that these are the same for all full factorial designs.

\*\*\*\*\* Analysis of Variance \*\*\*\*\*

84 cases accepted.  
 0 cases rejected because of out-of-range factor values.  
 0 cases rejected because of missing data.  
 1 non-empty cell.  
  
 1 design will be processed.

-----  
 \*\*\*\*\* Analysis of Variance -- Design 1 \*\*\*\*\*

EFFECT .. WITHIN CELLS Regression  
 Multivariate Tests of Significance (S = 4, M = 0, N = 36 1/2)

Test Name	Value	Approx. F	Hypoth. DF	Error DF	Sig. of F
Pillais	.24112	1.00068	20.00	312.00	.461
Hotellings	.27432	1.00813	20.00	294.00	.452
Wilks	.77346	1.00540	20.00	249.70	.456
Roys	.15431				

-----  
 Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.	Sq. Cor
----------	------------	------	-----------	------------	---------

1	.18247	66.51609	66.51609	.39282	.15431
2	.07202	26.25463	92.77072	.25920	.06718
3	.01249	4.55374	97.32446	.11108	.01234
4	.00734	2.67554	100.00000	.08536	.00729

-----  
Dimension Reduction Analysis

Roots	Wilks L.	F	Hypoth. DF	Error DF	Sig. of F
1 TO 4	.77346	1.00540	20.00	249.70	.456
2 TO 4	.91460	.57588	12.00	201.37	.860
3 TO 4	.98047	.25442	6.00	154.00	.957
4 TO 4	.99271	.28624	2.00	78.00	.752

-----  
EFFECT .. WITHIN CELLS Regression (Cont.)  
Univariate F-tests with (4,79) D. F.

Variable	Sq. Mul. R	Adj. R-sq.	Hypoth. MS	Error MS	F	Sig. of F
EW_Quest	.02305	.00000	.04920	.10560	.46589	.761
PunD_Que	.14093	.09743	.65912	.20343	3.24000	.016
AS_Quest	.00812	.00000	.04433	.27408	.16173	.957
DD_Quest	.06306	.01562	.34291	.25798	1.32924	.266
PerD_Que	.01333	.00000	.07124	.26698	.26682	.898

-----  
Raw canonical coefficients for DEPENDENT variables  
Function No.

Variable	1	2	3	4
EW_Quest	-.76193	1.36218	.23516	3.53123
PunD_Que	2.18318	.44868	-.09874	-.24659

AS_Quest	.50358	.13277	-.94456	-1.00424
DD_Quest	.09466	-1.70178	-.13678	1.15622
PerD_Que	-.32526	-.25004	2.19111	-1.16580

-----  
Standardized canonical coefficients for DEPENDENT variables  
Function No.

Variable	1	2	3	4
EW_Quest	-.24440	.43693	.07543	1.13267
PunD_Que	1.03647	.21301	-.04688	-.11707
AS_Quest	.25826	.06809	-.48442	-.51502
DD_Quest	.04846	-.87119	-.07002	.59190
PerD_Que	-.16507	-.12690	1.11198	-.59164

-----  
Correlations between DEPENDENT and canonical variables  
Function No.

Variable	1	2	3	4
EW_Quest	.11803	.49263	.43329	.55888
PunD_Que	.94930	.12339	.23145	.15965
AS_Quest	.21075	.10984	.03053	-.24744
DD_Quest	.28711	-.85703	.14489	.31732
PerD_Que	.14190	-.03433	.90209	-.11899

-----  
Variance in dependent variables explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	21.24195	21.24195	3.27786	3.27786

2	20.11307	41.35501	1.35126	4.62912
3	21.54000	62.89502	.26575	4.89487
4	10.27829	73.17331	.07489	4.96976

-----  
Raw canonical coefficients for COVARIATES  
Function No.

COVARIATE	1	2	3	4
Responsi	-.32700	-.40256	1.09603	-1.98423
Affect_V	1.38280	.98788	1.22346	1.86964
Achievem	-.76355	-1.72917	-1.32990	.19711
Directiv	-1.72031	.58048	.93625	1.10861

-----  
Standardized canonical coefficients for COVARIATES  
CAN. VAR.

COVARIATE	1	2	3	4
Responsi	-.22400	-.27576	.75080	-1.35924
Affect_V	.98190	.70147	.86875	1.32759
Achievem	-.57913	-1.31151	-1.00868	.14950
Directiv	-.76056	.25663	.41393	.49013

-----  
Correlations between COVARIATES and canonical variables  
CAN. VAR.

Covariate	1	2	3	4
Responsi	.06343	-.62718	.74862	-.20541
Affect_V	.37985	-.58591	.60130	.38841
Achievem	.02163	-.91893	.23756	.31409

Directiv                   -.85958                   .12802                   .37491                   .32277

-----  
 Variance in covariates explained by canonical variables

CAN. VAR.	Pct Var DEP	Cum Pct DEP	Pct Var COV	Cum Pct COV
1	3.42433	3.42433	22.19118	22.19118
2	2.68309	6.10743	39.93701	62.12819
3	.34514	6.45257	27.97455	90.10274
4	.07211	6.52468	9.89726	100.00000

-----  
 Regression analysis for WITHIN CELLS error term

--- Individual Univariate .9500 confidence intervals

Dependent variable .. EW\_Questionnaire                   PBDQ Emotional Warmth subscale - Mean Sc

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
Responsi	-.0347934802	-.0743055564	.08295	-.41947	.676	-.19989	.13031
Affect_V	.1085216647	.2402390977	.10013	1.08377	.282	-.09079	.30783
Achievem	-.0996911483	-.2357283043	.08274	-1.20487	.232	-.26438	.06500
Directiv	.0296066914	.0408075301	.08290	.35712	.722	-.13541	.19462

Dependent variable .. PunD\_Questionnaire                   PBDQ Punitive Discipline subscale - Mean

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
Responsi	-.0634652283	-.0915733615	.11512	-.55128	.583	-.29261	.16568
Affect_V	.2868405677	.4290201638	.13898	2.06393	.042	.01021	.56347
Achievem	-.1763922327	-.2818022660	.11484	-1.53602	.129	-.40497	.05219
Directiv	-.2771500474	-.2580924380	.11507	-2.40862	.018	-.50618	-.04812

Dependent variable .. AS\_Questionnaire                   PBDQ Autonomy Support subscale - Mean Sc

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
-----------	---	------	-----------	---------	-----------	------------	-----------

Responsi	.0036376552	.0048588792	.13363	.02722	.978	-.26234	.26962
Affect_V	.0550114161	.0761677659	.16132	.34102	.734	-.26608	.37610
Achievem	-.0621146374	-.0918629186	.13330	-.46599	.643	-.32743	.20320
Directiv	-.0749453087	-.0646079613	.13356	-.56113	.576	-.34079	.19090
Dependent variable .. DD_Questionnaire			PBDQ Democratic Discipline subscale - Me				

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
Responsi	.0084146586	.0112597764	.12964	.06491	.948	-.24963	.26646
Affect_V	.0035029593	.0048588352	.15650	.02238	.982	-.30801	.31502
Achievem	.1443320552	.2138394228	.12932	1.11609	.268	-.11307	.40174
Directiv	-.1422521884	-.1228511520	.12958	-1.09782	.276	-.40017	.11566
Dependent variable .. PerD_Questionnaire			PBDQ Permissive Discipline subscale - Me				

COVARIATE	B	Beta	Std. Err.	t-Value	Sig. of t	Lower -95%	CL- Upper
Responsi	.0585293026	.0790032206	.13189	.44379	.658	-.20398	.32104
Affect_V	.0872337968	.1220562557	.15921	.54791	.585	-.22967	.40414
Achievem	-.0824339606	-.1231996083	.13156	-.62660	.533	-.34429	.17943
Directiv	-.0093925599	-.0081824325	.13182	-.07125	.943	-.27177	.25299

-----  
 \* \* \* \* \* A n a l y s i s o f V a r i a n c e -- Design 1 \* \* \* \* \*

EFFECT .. CONSTANT  
 Multivariate Tests of Significance (S = 1, M = 1 1/2, N = 36 1/2)

Test Name	Value	Exact F	Hypoth. DF	Error DF	Sig. of F
Pillais	.83198	74.27426	5.00	75.00	.000
Hotellings	4.95162	74.27426	5.00	75.00	.000
Wilks	.16802	74.27426	5.00	75.00	.000
Roys	.83198				
Note.. F statistics are exact.					

-----  
 Eigenvalues and Canonical Correlations

Root No.	Eigenvalue	Pct.	Cum. Pct.	Canon Cor.
1	4.95162	100.00000	100.00000	.91213

-----  
 EFFECT .. CONSTANT (Cont.)

Univariate F-tests with (1,79) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
EW_Quest	30.07406	8.34277	30.07406	.10560	284.77963	.000
PunD_Que	29.62232	16.07105	29.62232	.20343	145.61357	.000
AS_Quest	27.29826	21.65269	27.29826	.27408	99.59790	.000
DD_Quest	16.92139	20.38020	16.92139	.25798	65.59257	.000
PerD_Que	25.13560	21.09172	25.13560	.26698	94.14653	.000

-----  
 EFFECT .. CONSTANT (Cont.)

Raw discriminant function coefficients

Variable	Function No.
	1
EW_Quest	-2.35661
PunD_Que	-.68249
AS_Quest	-.36216
DD_Quest	-.72351
PerD_Que	.34474

-----  
 Standardized discriminant function coefficients

Function No.

Variable	1
EW_Quest	-.76582
PunD_Que	-.30783
AS_Quest	-.18960
DD_Quest	-.36748
PerD_Que	.17813

-----

Estimates of effects for canonical variables  
 Canonical Variable

Parameter	1
1	-19.95568

-----

Correlations between DEPENDENT and canonical variables  
 Canonical Variable

Variable	1
EW_Quest	-.85323
PunD_Que	-.61012
AS_Quest	-.50459
DD_Quest	-.40949
PerD_Que	-.49059

-----

Abbreviated Name	Extended Name
Achievem	Achievement_Video
Affect_V	Affect_Video

AS_Quest	AS_Questionnaire
DD_Quest	DD_Questionnaire
Directiv	Directiveness_Video
EW_Quest	EW_Questionnaire
PerD_Que	PerD_Questionnaire
PunD_Que	PunD_Questionnaire
Responsi	Responsive_Video