Title
The Utility of Dynamic Assessment of Phonological Awareness for Bilingual Children in Singapore

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Publication Date
2018

Peer reviewed|Thesis/dissertation

The Utility of Dynamic Assessment of Phonological Awareness for Bilingual Children in Singapore

by

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A dissertation submitted in partial satisfaction of the

requirements for the degree of

Joint Doctor of Philosophy
with San Francisco State University

in

Special Education

in the

Graduate Division

of the

University of California, Berkeley

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Fall 2018

Abstract

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Joint Doctorate in Special Education

University of California, Berkeley & San Francisco State University

Professors Anne E. Cunningham & Philip Prinz, Co-Chairs

Early detection of reading difficulties is crucial in order to facilitate early intervention efforts. However, it may not be as straightforward to identify reading difficulties in children from bilingual backgrounds. This may be due to the considerable variability in their home language environment, and the fact that some difficulties faced by English language learners may present as similar to those with language learning disabilities. Dynamic assessment provides a potential mechanism to disaggregate these factors. In contrast to standardized assessment procedures, dynamic assessment allows the examiner to modify a prompt or provide extra scaffolding following a student's response, which helps to clarify the types of supports needed for the student to undertake a task successfully. Dynamic assessment has been lauded as a viable alternative for use with culturally and linguistically diverse populations because it may provide a more accurate measure of the young child's potential and response to instruction.

This study was conducted in Singapore, a multicultural society, with 99 preschool children (ages 4 to 5) from diverse language backgrounds. Parents and teachers filled in a Language Background Questionnaire and the children were grouped according to whether their family was Balanced Bilingual, English-dominant, or L2-dominant, depending on the languages spoken in the home. A battery of tests was administered to assess the children's receptive and expressive language in English, as well as a standardized and dynamic test of phonological awareness. Four to 6 months after the initial assessment, the children were again assessed on letter and word reading outcome measures.

Results demonstrated that both home language background as well as the child's receptive and expressive language in English impacted independently and significantly on phonological awareness. Hierarchical linear regression analyses indicated that prior letter identification/word reading explained close to 88% of the variance in the word reading outcome measure. However, the dynamic assessment task was found to be useful with children who had not yet learned to read at the time of the initial assessment. This study reveals the importance of language-specific skills for phonological awareness, highlights the importance of early intervention in reading, and supports the notion of the differential predictive validity of dynamic assessment.

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Acknowledgements

This journey embarking on my Ph.D. has been but one part of the great adventure that is called Life. That being said, it has been an extremely fulfilling season for me in which I have had the privilege to learn from esteemed faculty at both the University of California, Berkeley and San Francisco State University, as well as to bring back ideas for how to better serve the early childhood special education community in Singapore through research and practice. I would like to express my sincere gratitude to all the faculty and coursemates who have journeyed together with me in the last five years, especially to my dissertation committee and the faculty members who were in the committee for my qualifying examination: Professors Anne Cunningham, Philip Prinz, Stephen Hinshaw, P. David Pearson, and Summer Hsia. I would also like to thank numerous others for their unwavering support and practical assistance.

- Thanks especially to the co-chairs of my dissertation committee who have been with me from the beginning of the journey – to Anne, who assisted in securing me the Berkeley Graduate Fellowship and who has helped me navigate the various stages of the program; and to Philip, who never fails to provide an encouraging word and timely piece of advice.
- I am ever so grateful to have taken classes with David and Steve, and I have benefitted greatly from their immense pool of practical knowledge.
- To Summer and other faculty I have worked with such as Professors Susan Holloway, Betty Yu, Pamela Wolfberg, Pam Hunt, Frank Worrell, and Paul Li: the greatest thing about teaching is that whatever you give has a multiplicative effect. Thank you for giving of yourselves – from your time and your experience.
- To my coursemates and all those in the various research groups with me, especially Lakshmi Balasubramaniam, Kristan Stewart-Henry, Danielle Fleming, Dr. Yi-Jui (Iva) Chen, Robin Irey, Renee Starowicz, Leslie Buffen, Dr. Sunaina Shenoy, Dr. Maryam Salehomoum, as well as the many others who have offered advice and a sense of camaraderie, you have made this journey easier and all the more meaningful.
- Thank you also to the many others who have been of practical help with collecting the data and helping with translation of the consent forms and questionnaires, proof-reading, procuring research sites, and providing general encouragement and advice including Fiona Woo, Indrawati Liauw, Koay Poay Sun, Valerie Ho, Zakiah Zainudin, Chow Jia Ying, Alyssa Tan, Natalie Chiang, Dr. Koh Hwan Cui, Low Yung Ling, Pamela Chew, Tang Hui Nee, Dr. Faye Yang, Dr. Lily Lau, Dr. Caleb Goh, and Aaron Cohen.
- To my sisters Namiko Chan Takahashi, Esther Lim, Catherine Lee, Adeline Tan, Joyce Liu, Jody Wong, and Betty Ho, thank you for your prayers and encouragement along the way.
- To my family, especially my parents Dr. & Mrs. David & Beow Chu Yap, and my parents-in-law Mr. & Mrs. Vincent & Mary Leong: thank you for your wise counsel and prayers. And to my husband Stanley Leong, I very much appreciate your loving support throughout this process.
- Finally, thanks to God – the Creator and Origin of all ideas, wisdom and knowledge; the Living Word; Counsellor and Teacher – *Soli Deo gloria*.

Chapter 1: Introduction

Competent reading skills are crucial in modern society, as educational attainment is central to occupational outcomes and literacy difficulties may also have an impact on an individual's self-esteem, social adjustment, and psychological well-being (e.g., Maughan, 1995; Torgesen, 2002). The statistics are sobering: close to 75% of first-grade students who are at risk for reading difficulties will continue to have problems reading in adulthood and only 4% of children with serious reading difficulties finish college (Lyon, 2003; Neuman & Dickinson, 2001). Early, accurate identification for children considered at-risk for reading difficulties should be a first line of defense in preventing the manifestation of reading problems, since researchers have demonstrated that reading difficulties can be prevented when evidence-based practices are applied at an early age (e.g., Justice & Pullen, 2003; Petersen & Gillam, 2015; Torgesen et al., 2001; Vellutino, Scanlon, & Tanzman, 1998).

Instead of using the term *dyslexia*, reading difficulties are defined here as those which are not a result of general learning difficulties or factors such as sensory deficits, socioeconomic disadvantage, or lack of opportunity to learn to read (Vellutino, Fletcher, Snowling, & Scanlon, 2004). Similar to the viewpoint of Elliott and Grigorenko (2014), who pointed out that the actual cause of the reading difficulty is not so clearly defined or important, I agree that the term dyslexia "has surely outgrown its conceptual and diagnostic usefulness" (p. 177). Still, no matter what the label is, the fact remains that reading difficulties occur in about 3 to 10% of children in all languages studied so far, depending on the precise definition and criteria used (Snowling, 2013).

Despite the strong calls for early intervention and identification of reading difficulties, there are two primary concerns with the use of current screening tools. First, the methods tend to utilize a snapshot approach that does not consider the young child's development and learning (e.g., Speece, 2005). Second, current assessment tools do not take into account the performance of culturally and linguistically diverse children (e.g., Laing & Kamhi, 2003; Notari-Syverson, Losardo, & Lim, 2003), which is an important group to consider because exposure to more than one language may be more prevalent than monolingualism across the world (Grosjean, 2010).

Bilingualism is a key factor in this regard. Indeed, "rapid growth in immigration, combined with increasing awareness of the value of passing a heritage language to the next generation… has prompted a series of scientific investigations of the impact of early bilingualism on children's cognitive development" (Kuo & Anderson, 2010, p. 366). Over the past two decades, significant research has been conducted regarding theories of reading and what makes a good or expert reader, in a variety of languages (Kamil, Pearson, Moje, & Afflerbach, 2011; Neuman & Dickinson, 2001; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001). However, identifying a bilingual child with reading difficulties is problematic because any reading or language difficulties the child faces could possibly pertain to the child's acquisition of a second language (e.g., Geva, 2000; Klingner, Artiles, & Barletta, 2006; Wagner, Francis, & Morris, 2005). It has been argued that the same models of learning to read in an alphabetic language based on English-speaking children, which make up a majority of published literature in peer-reviewed journals over the last few decades, cannot account for reading skill development in bilingual children (e.g., Rickard Liow, 1999; Lonigan, Goodrich, & Farver, 2018). Instead, researchers now advise that models of bilingual reading development must accommodate the child's language proficiencies even before they learn to read (e.g., Koda, 2007). Furthermore, models of bilingual biscriptal reading development must take account of the

relation between the two scripts, and how learning these may influence the other (Ziegler & Goswami, 2005).

With all that is now known regarding the development of reading in English, as well as some of the issues concerning the early identification of reading difficulties in children from bilingual backgrounds, I proposed the use of dynamic assessment with a longitudinal approach to predict reading outcomes in bilingual children. My study included variables known to affect reading outcomes in young preschool children. My aim was to utilize dynamic assessment measures that tap phonological awareness, as the phonological deficit hypothesis (Stanovich, 1988) has been the dominant cognitive explanation for reading difficulties for the majority of the past four decades (Elliott & Grigorenko, 2014). In the following sections, I introduce the literature on phonological awareness, dynamic assessment, bilingualism, and the context of Singapore, all of which provide the empirical rationale and background of this dissertation.

I begin with the developmental model of reading, which posits that numerous factors come into play that produce variability in reading acquisition at different ages (e.g., Kamil et al., 2011; Neuman & Dickinson, 2001; Oakhill & Cain, 2012; Wagner et al., 1997).

The Importance of Phonological Awareness in Reading

Based on what is now known about reading development, phonological awareness (PA) is one of the most important variables to predict early reading (e.g., Adams, 1990; Blachman, 2000). As a child grows older, comprehension and vocabulary knowledge become more important to predict reading outcomes once a certain level of decoding proficiency has been reached (e.g., Kamil et al., 2011; Oakhill & Cain, 2012). In the current study, I focused on the component of PA — defined as the understanding that spoken words are composed of individual speech sounds, such as phonemes, and combinations of speech sounds, including syllables and onset-rimes (Vellutino et al., 2004) — because of its strong connection of such skills with early literacy development (e.g., Ehri et al., 2001; National Early Literacy Panel, 2008). Numerous studies have provided evidence that deficiencies in PA may cause reading difficulties, yielding a key factor targeted for intervention (e.g., Catts, McIlraith, Bridges, & Nielsen, 2017; Snowling, 2000; Vellutino et al., 2004). However, assessment of the PA of young children from bilingual backgrounds has its challenges, including a lack of familiarity with the task and deciding which language in which to assess (e.g., Geva, 2000; Wagner et al., 2005).

Thus, in order to circumvent this challenge of assessing children from bilingual backgrounds, researchers have proposed several approaches, focusing on processing-dependent procedures and methods which can be considered more naturalistic than traditional standardized testing (e.g., Laing & Kamhi, 2003; Notari-Syverson et al., 2003).

Dynamic Assessment

Dynamic assessment measures could be one of the solutions to address the problem of assessing the PA of culturally and linguistically diverse preschool children (e.g., Laing & Kamhi, 2003; Notari-Syverson et al., 2003; Wagner et al., 2005). Defined as “a general term used to describe a variety of evaluation approaches that emphasize the processes, in addition to the products, of assessment” (Spector, 1992, p. 354), dynamic assessment draws on the theoretical basis of Vygotsky’s zone of proximal development (as cited in Vellutino et al., 1998), the essence of which is the measurement of a child’s learning potential rather than his or her independent performance. Dynamic assessment seeks to show what the child can do with varying

levels of support, as the examiner may modify the testing format depending on the child's response.

The Use of Dynamic Assessment with Bilingual Children

There is evidence that dynamic assessment approaches may effectively identify language disorders in children from culturally and linguistically diverse backgrounds (e.g., Hasson, Camilleri, Jones, Smith, & Dodd, 2013; Kester, Peña, & Gillam, 2001). In this study, I adopted Kohnert's (2010) view of the bilingual individual as one who has received regular input in two or more languages, and who is likely to have a need for two different languages. As I elaborate upon in the next chapter, this is an intentionally broad definition of bilingualism, signaling heterogeneity in this group of learners. I proposed that dynamic assessment is a useful method of assessing PA in bilingual children because it addresses some of the issues faced when utilizing traditional standardized assessment measures in this population. The focus on process and learning potential, rather than on mastery, makes this approach especially appropriate for testing in cross-cultural settings because standardized tests do not account for cultural and linguistic influences on assessment content or contextual influences on the measurement of behavior (Notari-Syverson et al., 2003). Indeed, in the case of standardized assessment, the examiner is not allowed to rephrase, translate, or repeat the test instruction beyond the specified prompt. Thus, a child who is unable to understand the test instruction without further explanation would be at a disadvantage, even though language ability in itself may not be the focus of the assessment.

To conduct my research study, I required a sample of bilingual children. Singapore offers a "natural experiment" (Dixon, Chuang, & Quiroz, 2012, p. 376) for studying the PA of bilingual children due to its multilingual residents and educational policy.

The Context of Singapore

Singapore represents a unique context in which to conduct research because of its multiracial society and emphasis on bilingualism. In terms of ethnic mix, Singapore has a majority ethnic Chinese population, consisting of 74.3% of the citizen population, followed by 13.4% Malay and 9% Indian (Singapore Department of Statistics, 2017). Four official languages are recognized: English, Mandarin, Malay, and Tamil. The lingua franca and main medium of instruction in kindergartens and schools is English, and the country's bilingual education policy requires children to learn Mandarin, Malay, or Tamil as their second language in kindergarten and schools – even though for some children, these three languages are rarely used in the home.

The compulsory school age in Singapore is 7 years, when children are expected to enroll in Primary One. In contrast to the situation once children reach primary school age in Singapore, when all schools come under the purview of the country's Ministry of Education, the preschool landscape is more varied, with a wide array of options for parents. A vast majority of children in Singapore attend preschool, with more than 99% of students attending at least 1 year of preschool. Options range from full-day childcare programs (up to 12 hours) to half-day kindergarten programs (3 to 4 hours), with curriculums also varying between Montessori and play-based programs to environments that resemble primary school settings. My sample was recruited from a range of childcare centers and kindergartens in order to be representative of children from a variety of language and socioeconomic backgrounds in Singapore.

Rationale for the Study

The aim of this study was to move toward early identification of reading difficulties in bilingual children by examining the contribution of dynamic assessment in assessing a known component of reading acquisition: phonological awareness. By including the variables known to affect reading outcomes in preschool children and measuring their reading progress at two time-points, one can better understand the factors that contribute to variability in reading outcomes. Longitudinal studies are particularly suited to illuminate the developmental trajectory of children with reading difficulties, and the age at which the child is assessed, and the choice of tests to be used, are informative of the pattern of development (e.g., Speech, 2005; Wagner et al., 1997). In addition to assessing the early predictors of reading in English, it is important to assess other aspects of language and to account for factors, such as socioeconomic status (SES), which have previously been demonstrated to contribute to variance in reading outcomes. Conducting the study in Singapore offered a variety of bilingual competencies within a multilingual context.

Given the broad aims of this study, three specific research questions follow:

1. Do typically developing preschool students in Singapore who have more exposure to English and better developed English language skills perform significantly better on standardized tests of phonological awareness in English, compared to students who have less exposure to English and poorer English language skills?
2. Adjusting for language measures, current letter and word knowledge, and the family's socioeconomic level, does a dynamic test of phonological awareness contribute additional variance above and beyond an earlier standardized measure of phonological awareness in predicting later phonological awareness, word reading outcomes, and pseudoword decoding?
3. Are specific students prototypical in terms of literacy development and performance on the targeted assessments? In particular, how well does home language background predict the children's performance on the language and literacy assessments?

Having laid out an overview of the issues related to the use of dynamic assessment with bilingual learners in Chapter 1, I unpack these ideas further in Chapter 2 via a critical review of the relevant literature.

Chapter 2: Review of the Literature

Three interrelated areas form the theoretical basis for the research questions introduced in Chapter 1: (a) the heterogeneity of bilingual children and the need to adequately describe the sample in any study; (b) the link between early language and emergent literacy; and (c) effective methods to predict later reading ability in bilingual children through the use of dynamic assessment. In this chapter, I provide more detailed background in these areas through a critical review of the relevant literature. After discussing the heterogeneity of bilingualism, I focus on the theoretical models of reading and on the development of phonological awareness in monolingual and bilingual children. I then discuss the role dynamic assessment plays in the assessment of young children from culturally and linguistically diverse backgrounds, comparing dynamic assessment with traditional standardized assessment.

Bilingualism

The issue of bilingualism cannot be ignored, as exposure to more than one language may be more prevalent than monolingualism across the world (Grosjean, 2010). Yet this group of bilingual individuals is extremely varied in terms of the languages spoken and the extent of proficiency in either language. Thus, there are several factors to be considered in a description of any bilingual sample.

The Heterogeneity of Bilingual Individuals

The definition of the bilingual individual as one who has received regular input in two or more languages before adolescence, and who would be required to use two different languages to some extent (Kohnert, 2010), encompasses a wide range of language learners. In terms of definitions, some might argue that only a person who has fluency in both languages who can be considered truly bilingual (e.g., Bloomfield, as cited in Bialystok, 2001). However, it is not easy to define language proficiency — there are often theoretical, methodological, cultural, and other variables to consider, and there is no universally accepted assessment to determine one's level of language fluency (e.g., Bialystok, 2001). As pointed out by Luk and Bialystok (2013) in their study with young adults, bilingualism is not a categorical variable; rather, bilingual experience is dynamic, and there are various dimensions to consider, including usage, language proficiency, and acquisition history.

Ultimately, each bilingual person should be viewed as a unique individual. A bilingual individual cannot be expected to be "two monolinguals in one person" (Grosjean, 1989, p. 3). This would lead to several problems, such as appraising their language skills in terms of monolingual standards and conducting research only in terms of their individual and separate languages. When there is a more flexible and broader definition of bilingualism, researchers and practitioners may then take into account the heterogeneity of bilingual learners, and view these learners through a strengths-based instead of a deficit lens (Grosjean, 1989). As illustrated in the next section, there are many factors to consider when bilingual learners are discussed in any study.

Factors to Consider when Describing the Bilingual Sample

A number of factors are critical when considering second language learning or bilingualism (Paradis, Genesee, & Crago, 2011). To begin with, researchers generally distinguish whether the child learns both languages from infancy or whether the child learns the second language after his or her first language was established. The first category, simultaneous

bilingual learners, learns both languages before the age of 3, and can usually achieve native-like fluency in both languages. The second category is sequential bilingual learners (Gregory, 2008). The focus of the present study was on simultaneous or early sequential bilinguals. For this group in particular, there are a number of defining characteristics of language proficiency (Kohnert, Windsor, & Ebert, 2009). First, both absolute and relative levels of ability in both languages are fluid, changing with age and corresponding experiences in each language across development. Also, there is considerable variation in individual acquisition rates and outcomes, even among children acquiring the same two languages under highly similar circumstances (e.g., Hammer et al., 2014; Kohnert et al., 2009).

Thus, two mechanisms are fundamental when considering the heterogeneity of bilinguals: competition or interference between languages, and frequency of use (Mindt et al., 2008). Typically, languages that are similar to each other in script and phonetics may cause transfer, which helps the language learning process (Kroll, Bogulski, & McClain, 2012). In terms of frequency of use, factors to be considered when describing the bilingual individual include whether he or she is a member of a majority or minority ethnolinguistic community, and the status of the second language in that particular setting (Cummins, 1984; Schieffelin & Ochs, 1986). In addition, broader social variables such as SES, which affect many aspects of academic achievement, need to be considered (e.g., Hoff, 2006). These external factors interact with internal factors for children — such as general cognitive ability, phonological memory, as well as social and personality variables — to affect language outcomes (e.g., Hoff, 2014; Paradis et al., 2011; Service, 1992).

It is also important to distinguish between the two related terms of language proficiency and language dominance, as they are not synonymous (Bedore et al., 2012). Language dominance refers to the languages to which the child is exposed, and which language may be stronger relative to the other(s) in terms of comprehension and expressive language ability (Gathercole & Thomas, 2009; Grosjean, 2010). On the other hand, language proficiency refers to the competence of the child in various aspects of vocabulary, grammar, comprehension, and pragmatic use, which may be defined in comparison to those of a monolingual speaker (e.g., Bialystok, Luk, Peets, & Yang, 2010). I considered both these aspects of language dominance and language proficiency in my sample through the use of a Language Background Questionnaire (LBQ) and also the administration of objective assessment measures.

Having considered the importance of describing the bilingual sample in any study, I now discuss the relationship between language and reading development, and other factors that contribute to children's reading outcomes.

What Contributes to Reading Development?

Much is now known about children's reading development, which provides the theoretical basis for my study. In this section, I outline the reasons for considering language in any study of reading for bilingual learners, and then reiterate why phonological awareness is the focus of my study.

The Relationship Between Language and Reading Development

Language and literacy are closely related, and it has been found that language development and language disability predict later reading disabilities, as literacy builds on earlier-acquired oral language skills (e.g., Bishop & Snowling, 2004; Catts, Fey, Tomblin, &

Zhang, 2002; Howard et al., 2014; National Institute of Child Health and Development [NICHD], 2005). Specifically, early language disorders in preschool children have been associated with later difficulties in learning to read and write (e.g., Tomblin, Zhang, Buckwalter, & O'Brien, 2003). Because of significant overlap between linguistic and literacy skills, researchers have suggested identification of reading difficulties should include assessment and understanding of the child's language background (e.g., Catts, 1991).

Despite the association between these two constructs, early language development is not the only predictor of later literacy outcomes (e.g., Ghassabian et al., 2013; Rescorla, 2009); several other factors such as family history of language/learning difficulties play an important role as well. The age at which a child is assessed, the type of measurement used, and the specific type of reading difficulty under investigation are all important considerations in studies that seek to better understand the variables that facilitate or challenge reading development in children across the age span (e.g., Howard et al., 2014; Oakhill & Cain, 2012). For example, in a recent longitudinal study investigating the link between infant vocabulary skills at 2 years old and later reading outcomes, infant vocabulary was found to account for 16% of variance in later vocabulary, 4% in phonological awareness, 11% in reading accuracy, and 18% in reading comprehension (Duff, Reen, Plunkett, & Nation, 2015). This set of findings suggests that vocabulary knowledge when measured by parental report before 2 years is not a sufficiently reliable predictor of language outcomes, and therefore not a sufficiently sensitive indicator of risk for language delay and need for early intervention. Similarly, findings have suggested that screening for language problems at 3½ years of age provides less useful information with respect to later dyslexia, especially compared to the predictor of family history of language/literacy difficulties. Language was found to be an important predictor of dyslexia when measured at ages 5½ through 7, but not before (Thompson et al., 2015).

The most important take-away from this longitudinal study by Thompson and colleagues (2015) was that different risk factors best predict outcomes at different ages. For example, at age 3½, when the children were first assessed, the researchers found that a model containing only family-risk status and letter knowledge best predicted dyslexia outcome. At older ages, measures of phonological awareness, rapid automatized naming (RAN), executive skills, and motor skills increased the probability of accurate identification. Thus, along with other longitudinal studies, Thompson and colleagues demonstrated the relative importance of different factors across the developmental trajectory, showing the need to take development into consideration, and supporting the power of adopting a longitudinal approach (e.g., Speece, 2005).

Why Focus on Phonological Awareness?

Similar to those studies on dyslexia risk, different factors come into play that produce variability in reading acquisition at different ages. It is now well established (e.g., Kamil et al., 2011; Neuman & Dickinson, 2001) that three independent predictors of children's later word-reading skills across languages are as follows: (a) phonemic awareness (the ability to isolate phonemes in spoken words), (b) letter-sound knowledge (knowledge of letters and sounds associated with printed letters), and (c) RAN (the speed of naming lists of objects, colors, digits, or letters). In a study involving English, Czech, Slovak, and Spanish, these three key measures had the same relative importance as predictors of early literacy skills in all four languages (Caravolas et al., 2012). However, these variables were found to account for only modest amounts of variance in literacy skills after accounting for the variance in prior reading and spelling measures in the multigroup path models. The researchers therefore concluded that it is

important to trace the earlier antecedents of these skills in studies of younger children before any knowledge of letter-sound relationships is acquired.

The present study focused on decoding and letter/word identification (an aspect of metalinguistic awareness), as this is among the best predictors in early literacy when children are beginning to read. As summarized in a report by the National Early Literacy Panel (2008), the predictor variables most highly correlated with early decoding performance were other conventional literacy variables, including alphabet knowledge and phonological awareness (PA). Other precursor literacy skills which had medium to large correlations with later conventional literacy skills included RAN of letters, digits, objects, or colors, and phonological memory. The report also noted that PA was a stronger predictor of decoding than concepts about print and oral language.

Over and above all other factors, PA has consistently been identified as having a crucial role in reading in English (e.g., Adams, 1990; Blachman, 2000; Bradley & Bryant, 1983). This factor has not only been identified as a strength in good readers but also as a deficit in children with reading difficulties (e.g., Catts, 1991; Snowling, 2000; Stanovich & Siegel, 1994). In a multifactorial causal model of reading difficulties, a phonological deficit could still be a primary causal factor, but is accompanied by other biological or environmental risk factors (Catts et al., 2017; Pennington & Olson, 2005). Yet, as found by Caravolas and colleagues (2012) along with numerous other scholars, it is also important to be aware of the bidirectional predictive relationship between PA and letter knowledge (e.g., Lerner & Lonigan, 2016; Rayner et al., 2001).

How Children Develop Phonological Awareness

Typically-developing monolingual speakers of alphabetic languages usually develop PA in the same way — progressing from larger to smaller units (e.g., syllables and onset-rime before individual phonemes) and being able to identify beginning and end sounds before medial sounds (e.g., recognizing that *cat* begins with */k/* and ends with */t/* before being able to identify that */ā/* is in the middle) (e.g., Anthony & Francis, 2005; Blachman, 2000; Carroll, Snowling, Stevenson, & Hulme, 2003). These individuals pick up these sound patterns even without being explicitly taught them and can usually guess how to read or spell a new word even if they have not encountered it before. On the other hand, individuals with reading difficulties may not be able to "break the code" without being taught explicitly (e.g., Blachman, 2000; Rayner et al., 2001; Vellutino et al., 2004). These individuals have difficulty reading pseudowords and identifying the individual syllables or phonemes in words (e.g., Stanovich, 1988; Stanovich & Siegel, 1994).

Turning to evidence from intervention studies, systematic instruction in learning letter-sound relations and in blending sounds to form words (i.e., phonics instruction) has been found to be most effective for improving reading and spelling skills in children with reading difficulties (e.g., Galuschka, Ise, Krick, & Schulte-Körne, 2014; NICHD, 2000).

In addition, it is important to note that PA, or even the more specific construct of phonemic awareness – defined as the ability to focus on and manipulate the smallest units of sound in spoken words (Ehri et al., 2001) – does not consist of merely one aspect. PA can be measured by performance on a wide range of tasks, including rhyming; isolating beginning, medial, and ending sounds; breaking words into their component sounds; saying words with target sounds deleted; and producing invented spellings (e.g., Blachman, 2000; Spector, 1992).

Phonological Awareness in Bilingual Children

Focusing on the topic of the PA of children who speak a language other than English, several studies have also provided empirical findings demonstrating that PA is strongly related to beginning word-reading skill in other alphabetic orthographies such as Italian (e.g., D'Angiulli, Siegel, & Serra, 2001), French (e.g., Lafrance & Gottardo, 2005), Spanish (e.g., Swanson, Rosston, Gerber, & Solari, 2008), and even non-alphabetic languages such as Chinese (Gottardo, Yan, Siegel, & Wade-Woolley, 2001) and Korean (Wang, Park, & Lee, 2006). Although children with dyslexia from different countries show similar underlying phonological deficits (Brunswick, 2010), any differences in phonological processing of bilingual children would have implications for assessing this ability in a bilingual sample. For example, some researchers have proposed that there is a bilingual advantage in the development of PA for bilingual children, based on the reasoning that individuals exposed to more than one language have advantages in terms of metacognition and metalinguistic ability, including the flexibility to understand that one concept can be represented by different words and having greater awareness of the structure of words (Kuo & Anderson, 2010). However, the general consensus from the literature seems to be that the extent of the bilingual facilitation for early reading depends on the relation between the two languages and corresponding writing systems (e.g., Bialystok, Luk, & Kwan, 2005).

Following the classical theory of transfer (e.g., Osgood, as cited in Kuo, Uchikoshi, Kim, & Yang, 2016), cross-language transfer is used to predict how the learning of a particular language facilitates the learning of another language depending on the similarities between the two languages, such as a particular phoneme or a particular phonological structure. Positive transfer would be even more likely to occur if that particular linguistic feature is more prominent or complex in the language first learned in comparison to the second language. However, negative transfer could also occur if the dominant language has a simpler or less salient linguistic feature than the less dominant language (e.g., Bialystok, Majumder, & Martin, 2003). Cross-language transfer theory has also explained null and negative effects among bilinguals who speak different pairs of languages.

Bialystok (2007) proposed that the role of bilingualism alone was likely to be neutral in children's development of PA skills necessary for reading, probably depending on the languages involved. Empirical research on the effect of bilingualism on PA has produced mixed results, with some but not all studies offering evidence for the transfer of PA in bilingual individuals (Bialystok et al., 2003; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Liow & Poon, 1998). In summary, in the majority of the studies that have reported superior performance by bilingual children, the bilingual children spoke an additional language with one of the following features: (a) simpler and more regular phonological structures, (b) more salient segmental units, or (c) a more transparent orthography (Kuo & Anderson, 2010). Therefore, one can conclude that "the effect of bilingualism on metalinguistic awareness involves complex and multi-faceted processes" (Kuo et al., 2016, p. 8). The extent to which PA is associated with reading development depends on the language and script involved, as well as the developmental level of the child (e.g., McBride-Chang et al., 2005).

This question becomes even more pertinent when considering languages with different orthographies, such as English and Chinese. Even in nonalphabetic scripts such as Chinese, PA is a good predictor of very early reading (e.g., Ho & Bryant, 1997; McBride-Chang & Kail, 2002). Yet, the grain size theory posits that reading procedures assemble phonology according to the grain size of the orthography (i.e., how the orthography can be broken down in a meaningful

way, whether this be at the alphabetic or syllabic level, for example) (Ziegler & Goswami, 2005). As an illustration of this theory, the studies finding that PA is important for learning to read Chinese used larger units, such as syllables and onset-rime, rather than individual phonemes (Ho & Bryant, 1997; McBride-Chang & Kail, 2002). Therefore, it is highly likely that a phonological task based in English would still tap the child's experience in English, even if it is supposed to measure PA rather than the child's English language skills. In this study, I aimed to clarify the question as to whether the amount of English spoken or used at home has a direct relation with a bilingual child's performance on PA tests administered in English.

As mentioned in the previous chapter, dynamic assessment could be a way of evaluating bilingual children's PA, especially since standardized assessment has its limitations, as will be elaborated on in the next section.

Types of Assessment Procedures

There are various ways which could be used to assess children's PA. Standardized assessment is often considered the gold standard of assessment procedures. In this next section, I outline the inadequacies of standardized assessment procedures and contend that dynamic assessment may be a viable alternative to consider.

The Shortcomings of Standardized Measures

In my consideration of traditional assessment procedures, focusing on standardized assessment, I note that assessment is a social practice, because the assessment tool one chooses also reflects the aims of the assessment, with its own cultural and societal norms (Garcia & Pearson, 1993; Johnston & Costello, 2005). Standardized test measures do not acknowledge the fluid nature of what counts as useful knowledge, or the continuously shifting character of pedagogy (Dixon-Román & Gergen, 2013). In their review of assessment and its use for students from diverse backgrounds, Garcia and Pearson (1993) pointed out that every test has its bias. Their critique of standardized tests was that "while they are quite good at indicating a student's relative standing in a group, they provide few, if any, clues about the locus of the performance" (Garcia & Pearson, 1993, p. 341). They maintained that the norming process by nature would lean toward the mainstream culture, and therefore question whether a test can truly be "culture-free," or at best only "culture-fair."

Standardized assessment yields a static picture of what the child has already learned. Responses are usually dichotomous — either correct or incorrect — and credit given accordingly; a zero on the test could be due to a variety of different reasons (e.g., Cho et al., 2017; Elliott, 2003; Spector, 1992). As a specific example, it has been pointed out that many phonemic awareness tasks are unfamiliar and complex, especially for kindergarten children. Therefore, poor performance on a phoneme segmentation task might indicate low phonemic awareness or the child's lack of understanding of task requirements, limited attention span, or other factors (Spector, 1992). Thus, static assessments do not allow children to demonstrate their learning potential (e.g., Bridges & Catts, 2011). Traditional psychometric measures do not assess qualitative and quantitative changes that occur as a result of development (Meltzer, 1994).

Even more, standardized tests often do not address multicultural issues, such as cultural and linguistic influences and differences, contextual influences, and alternative pathways in development (Notari-Syverson et al., 2003). Because the power of the standardized assessment lies in it being administered in exactly the same way every time, it does not give room for

cultural differences in terms of response time, adapting the stimuli to suit the individual child's background, or additional clarification of test instructions, just to name a few. One example might be a tool such as the *Peabody Picture Vocabulary Test* (PPVT; Dunn & Dunn, 2007), commonly used to measure a child's single-word receptive vocabulary. For a child from a diverse cultural or linguistic background, the test may not accurately reflect his or her knowledge because the words or pictures used may be less familiar. As another example, some children may be less likely to guess at a response if they are not fully sure of the correct answer, potentially resulting in a lower score on a standardized test compared to the child who is more willing to guess at a response because of the parent or school teacher's encouragement to do so in the past.

The case for using standardized tests with young children becomes even weaker when considering that assessments for preschool populations have poorer reliability and validity than those developed for school-age children, because of smaller sample sizes and an inappropriate assumption that growth occurs in a linear fashion during the preschool years (Spector, 1999). Investigating the reliability and validity of standardized preschool tests across a wide range of domains, including cognitive development, speech and language, behavior, and socioemotional functioning, Bracken (1987) found that many tests had poor reliability, an inadequate floor and ceiling, and low predictive validity. In addition, because young children have not been exposed to the common school environment, they are especially influenced by contextual factors due to the wide variety of home and preschool settings they are exposed to (e.g., Bracken, 1987; Bridges & Catts, 2011; Spector, 1999).

Dynamic Assessment: An Alternative to Standardized Measures

Despite many variants of dynamic assessment, it differs from traditional testing in three main ways: (a) the nature of the relationship between the examiner and the student, (b) the content of feedback given to the student, and (c) the emphasis on process rather than on product (Grigorenko & Sternberg, 1998). Underlying dynamic assessment is a belief in the modifiability and plasticity of the thinking process, and an emphasis on the adult as a mediator in the assessment process (Meltzer, 1994). Some scholars have likened it to well-known learning procedures, such as mediated learning, guided learning, testing the limits, learning potential assessments, mediated assessment, assisted learning and graduated prompts (Caffrey, Fuchs, & Fuchs, 2008; Cho & Compton, 2015). In other words, the commonality across various dynamic assessment approaches is that instruction and feedback are built into the testing process and are contingent on the individual's performance (Elliott, 2003).

There is a stark difference in the theoretical underpinnings of standardized and dynamic assessment. Although standardized assessment has its roots in psychometric testing and the conceptualization of the measurement of learning ability in a way that is valid and reliable, the goal of dynamic assessment is "to evaluate, to intervene, and to change" (Grigorenko & Sternberg, 1998, p. 76). This is why it is said that the learning is embedded in the evaluation. Assessment often remains separated from instruction. Ability and achievements tests often have not informed instruction adequately to help teachers address their students' needs (Campione, 1989). Dynamic assessment and other interactive approaches may help to provide this link between assessment and instruction. These are a form of authentic assessments, in that that they are situated in the classroom, designed by the teacher, and used to evaluate student performance within the classroom curriculum context (Calfee & Hiebert, 1991).

The use of dynamic assessment may allow for the differentiation of students who initially fall at the lower end of the distribution because of limited literacy experience or poor instruction and those who truly are at risk for reading disabilities (e.g., Bridges & Catts, 2011). It is purported to provide greater opportunity for task analysis and could account for the influence of motivation, personality, and social factors on learning, in a way standardized tests do not (e.g., Bridges & Catts; Johnston & Costello, 2005; Spector, 1992).

Dynamic assessment requires active intervention by the examiners and an assessment of the examinees' response to intervention (RTI). At this point, I mention briefly the concept of RTI. Although dynamic assessment is not the same as RTI, these two concepts have been referred to as "two sides of the same coin" (Grigorenko, 2009, p. 127), even though historically, the concept of dynamic assessment is much older than that of RTI. The popularity and promise of RTI is in the prevention instruction model (Johnston, 2011). Comparing RTI and dynamic assessment, Grigorenko (2009) made the case that both concepts responded to similar practical needs of improving precision in addressing the educational profiles of children with special needs, and that both concepts assume an interaction of assessment and instruction. In sum, Grigorenko purported that whereas dynamic assessment and RTI go by different names, they are closely related, and both (or the single construct that underlies both concepts) place an emphasis on services rather than diagnostics. Fuchs and colleagues (2007) went further to question whether dynamic assessment can be seen as a more efficient version of RTI, especially given that it might take far longer before a child is identified having a learning disability across the many tiers of instruction. From their perspective, the benefit of dynamic assessment is that it can give an index of a child's readiness to change and, as such, represents a unique means of differentiating performance among children at the low end of the achievement continuum (Fuchs et al. 2007).

Cho and Compton (2015) described the scenario in which children who perform similarly on an assessment may require different amounts of support to reach a desired competence level. They discussed Vygotsky's (as cited in as Cho & Compton, 2015) notions of actualized and actualizing developmental levels, with the zone of proximal development being the gap between these two levels. Dynamic assessment can be used to improve academic performance by providing scaffolding, or guided assistance, to help a child move toward greater independence within his or her zone of proximal development and thereby narrow the difference between actual and potential performance (Abbott, Reed, Abbott, & Berninger, 1997). In their recent study involving first-grade students tested at two time-points 6 months apart, Cho and colleagues (2017) developed a dynamic assessment of word reading that mirrors cognitive skills required for acquiring word reading skills, and concluded that dynamic assessment is useful only with some students, and not all students need it, which they dub as "differential predictive validity" (p. 98).

In summary, dynamic assessment arose due to the need for assessing individuals from diverse cultural backgrounds, whose performance on standardized assessment was greatly limited or painted an inaccurate picture of their true ability. It provides an interactive way for an examiner to obtain more information about the examinee, often giving opportunity for the examinee to demonstrate the types of support needed in order to achieve the desired learning outcome (e.g., Cho et al., 2017; Elliott, 2003; Fuchs et al., 2007). Yet despite its advantages, it is undeniable that dynamic assessment also has its limitations.

Critique of Dynamic Assessment

Critics of the dynamic assessment paradigm often concede that the theoretical background and concept seem attractive, but focus on the difficulty in implementation. Elliott (2003) argued that dynamic assessment is "an approach that has great intuitive appeal for many professional psychologists and teachers, yet which has, to date, failed to take root in mainstream practice" (p. 15). Indeed, one may wonder why, with its rich theoretical background and historical context, dynamic assessment is not being used more often in today's educational context for children who are struggling.

The fact remains that dynamic assessment data cannot be used for classification, and there are no normative tables for comparative interpretation (e.g. Caffrey et al., 2008; Elliott, 2003). This is due simply to the nature of dynamic assessment, in which the assessment questions could be contingent upon the child's response. Also, unlike in standardized assessment, much of the interpretation of dynamic assessment data depends on the skill and experience of the examiner (e.g., Grigorenko & Sternberg, 1998). The accuracy of predictions based on dynamic assessment is likely to be greatly influenced by environmental factors. In a review of the literature, Sternberg and Grigorenko (2002) contended that evidence of greater predictive validity on the part of dynamic tests generally remains unpersuasive. Three concerns are typically expressed about dynamic assessment: namely, it is not well-defined, its technical characteristics in terms of reliability and validity are largely unknown, and its administration and scoring are labor-intensive, as time is required to develop the protocol and to train examiners (e.g., Caffrey et al., 2008; Cho & Compton, 2015; Frisby & Braden, 1992; Grigorenko & Sternberg, 1998). Therefore, some researchers have queried whether the information it adds is worth the extra time taken to administer these assessments. Dynamic assessment needs to show its value above and beyond currently used predictors. In other words, the benefits need to outweigh the costs.

In light of these critiques and the empirical evidence against dynamic assessment, perhaps the question should not be whether dynamic assessment can indeed replace standardized assessment, but instead how dynamic assessment can be used to shed more light on the child's level of functioning. In other words, one could explore what unique and complementary information dynamic assessment can provide.

Dynamic Assessment as a Complement to Standardized Tests

In their synthesis of the literature on dynamic assessment, the main conclusion of Swanson and Lussier (2001) complemented the findings of Grigorenko and Sternberg (1998), but added that dynamic assessment procedures may provide an estimate of processing potential not necessarily tapped by static measures. They arrived at this conclusion because dynamic assessment measures seemed to provide different outcomes from static measures. As I have previously suggested, dynamic assessment may represent a less biased measure of school achievement for certain student groups because it is less dependent on mainstream language skills and background experience. Moreover, it can point toward educational interventions that may be more readily designed because of the close link between assessment and instruction. By providing insight into the unique nature of an individual's learning and reasoning, an individually tailored intervention could be developed to suit the individual's profile (Elliott, 2003). In addition, dynamic assessment has the potential to predict future student achievement because it attempts to measure both level of performance and rate of growth. Based on a review

of the literature, Caffrey and colleagues (2008) found that dynamic assessment contributes significant, unique variance to the prediction of students' general reasoning, verbal achievement, and mathematics achievement, and taps achievement differently than traditional achievement and cognitive tests.

Presently, even champions of dynamic assessment recommend that it is to be used in conjunction with other forms of assessment, and not isolated from or instead of standardized tests (e.g., Campione, 1989; Grigorenko & Sternberg, 1998; Meltzer, 1994; Tzuriel, 1992). Specifically in the context of reading, dynamic assessment may be useful in distinguishing an unskilled reader who is not yet ready to acquire beginning reading skills from a currently unskilled reader who is ready to learn after pertinent instruction (Caffrey et al., 2008). As it is closely related to teaching, it may have an important role to play in helping the teacher decide what to teach or how to support the student or small group in learning. One role of dynamic assessment may be to identify obstacles that hinder more effective learning and performance, to find ways to overcome these obstacles, and to assess the effects of removal of obstacles on subsequent learning and performance effectiveness.

Returning to the issue at hand regarding unbiased assessment of culturally and linguistically diverse children's language and literacy, Laing and Kamhi (2003) reviewed empirical studies involving dynamic assessment, including the test-teach-retest format, task/stimulus variability, and graduated prompting. Their conclusion was that the use of processing-dependent measures, that are minimally dependent on prior knowledge and experience (e.g., memory, perceptual, and competing stimuli tasks), and dynamic assessment measures remain promising because they are not biased toward life experiences, socialization practices, or literacy knowledge.

In this section, I have demonstrated that dynamic assessment has a role to play in providing additional information about a child's abilities, especially in relation to his or her learning needs. Although these theoretical and empirical papers have been more general in terms of learning ability and intelligence, there have also been many studies which have explored the use of dynamic assessment in specific areas, such as school-related skills.

Studies that Involve Dynamic Assessment and Phonological Awareness

In the earlier section on the importance of PA in reading development, I provided rationale for why the proposed study should focus on PA assessment, while taking into account the child's language skills and prior literacy experience. On the specific topic of the dynamic assessment of PA, one possible obstacle to assessing PA in young children is the unfamiliarity and complexity of many PA tasks. As mentioned earlier, poor performance on any PA task might indicate low phonemic awareness or reflect the child's lack of understanding of task requirements as well as other aspects of the task (Spector, 1992). In other words, one of the issues with static assessment — an incorrect response does not give clear indication of the nature of the child's difficulty. This speaks to the issues of task analysis, and of the different goals of static compared to dynamic assessment. Another limitation of using standardized tools to measure PA is that these measures may be characterized by floor effects due to the large number of children lacking literacy experience at the beginning of kindergarten (e.g., Bridges & Catts, 2011). Once again, dynamic assessment seeks to solve this problem by providing a wider range of possible scores, as the task is broken down and children have more opportunities to succeed on the task as compared to a simple right/wrong paradigm.

Based on a literature review of the topic, I found five studies that support the predictive utility of a dynamic assessment for PA compared to more static measures (Bridges & Catts, 2011; Cunningham & Carroll, 2011; Gellert & Elbro, 2017; Petersen, Allen, & Spencer, 2016; Spector, 1992), and two studies which did not find that it added significant value beyond traditional standardized tests (Coventry, Byrne, Olson, Corley, & Samuelsson, 2011; Kantor, Wagner, Torgesen, & Rashotte, 2011). In the earliest study conducted, Spector (1992) designed a dynamic phoneme segmentation task in which she provided corrective feedback and increasingly supportive prompts and cues when the children were unable to segment the corresponding word correctly. These ranged from a less intrusive prompt of pronouncing the target word slowly to using physical representation of the sounds in a word. When assessed again at the end of the school year, the results supported the hypothesis that the dynamic phoneme segmentation was a better predictor of kindergarten reading progress than any of the three static measures of phonemic awareness, as well as the *PPVT*, a measure that is often used to estimate verbal ability (Spector, 1992). Similarly, the dynamic measure accounted for more variance in spring phonemic awareness than did any of the other fall phonemic awareness measures.

Most recently, based on a large-scale longitudinal study conducted with 600 students at the beginning of kindergarten and at the end of first grade, Petersen and colleagues (2016) found that the dynamic assessment tasks yielded significantly higher accuracy in classifying students who were having reading difficulty over the static measures. These findings have been further supported by researchers in Denmark (Gellert & Elbro, 2017). Thus, despite the use of different dynamic assessment procedures, they all involved preschool or kindergarten children and assessed word reading and later phonological processing skills as their outcome measures, concluding that a dynamic screening of PA can add to the prediction of early reading achievement and outcome.

On the other hand, other studies have not shed a positive light on dynamic assessment measures for PA. As part of the International Longitudinal Twin Study (ILTS), Coventry and colleagues (2011) conducted a longitudinal study of early literacy development using 1988 twin children from the United States, Australia, Norway, and Sweden, including monozygotic and dizygotic twins. Dynamic assessment was found to add 1% to the variance explained in kindergarten reading on top of the variance attributable to letter knowledge and static PA in preschool. The researchers therefore concluded that there was little advantage in electing to use the more time-consuming dynamic assessment of preschool PA over the conventional static method. They were also unable to distinguish between static and dynamic preschool assessment of PA in terms of underlying genetics (Coventry et al., 2011). In the same vein, Kantor and colleagues (2011) concluded that dynamic assessment did not appear to improve reliability or validity of PA assessments when preschool children were given tasks that they can perform using standard administration procedures.

Considering the large sample in the study by Coventry and colleagues (2011), one may be tempted to draw the conclusion that dynamic assessment is not worth the time and labor required to conduct such tasks. Yet the study by Kantor and colleagues (2011) did not include a sample that was not diverse in terms of ethnicity, language background, or SES, making the range of phonological processing ability too narrow. Similarly, the only requirement to be included in the ILTS was that the participants had to be twins of the target age. As previously discussed, dynamic assessment is intended for children who struggle with the task at hand, as indicated by the at-risk children chosen for the Spector (1992) and Bridges and Catts (2011)

study. Thus, it seems logical to conclude that standard assessment procedures work fine for children who can perform the task without support (Kantor et al., 2011). However, the role of dynamic assessment, one would hope, is that it can distinguish between two groups of children who struggle: those with and without a true specific reading disability. Therefore, although adding a dynamic assessment component would not be necessary for all children, it may still serve certain groups well, such as those from disadvantaged backgrounds (Coventry et al., 2011). In the case of the study by Petersen and colleagues (2016), the dynamic assessment tool served as a screener for a large group of children, and the results indicated that depending on how the assessment is used, dynamic assessment measures may still be promising in how much value they can add to the assessment process.

These studies on PA paint a picture of dynamic assessment having its place in providing extra information and predictive utility, especially for children who are at risk for dyslexia. However, in a study on this topic, the sample should be chosen carefully to reflect a wide enough range of students with varying abilities. There still remain questions as to whether the additional time taken on the dynamic assessment measure warrants the additional information it can provide.

Even with the studies which supported the predictive utility of dynamic assessment, one limitation of these studies is that none of these took into account prior reading in their models. Spector's (1992) study was very specific in identifying 38 non-readers for whom standardized assessments would have been unlikely to distinguish between the various groups. Based on my review of the literature, it appears that what is needed is to conduct a study with a sample of bilingual children, who may or may not have a language/learning disability, in order to examine the possibility that dynamic assessment can be useful for children from linguistically diverse backgrounds.

In addition, throughout my review of the literature, I found that the dynamic assessment tool was often researcher-developed, leading to various studies which cannot be compared to one another. This is one limitation of previous studies which I attempted to mitigate by utilizing Spector's (1992) measure. What may be needed is for more researchers to adopt or adapt tests that have already been developed, rather than each creating their own idiosyncratic versions for each construct in a test battery. It would then be important for the assessment process to be specified with a clear rubric so that others can replicate and thereby validate its usefulness in other settings and samples (e.g., Makel & Plucker, 2014). Only by building on the work of others who have gone before us can researchers further develop this field and bring the understanding of dynamic assessment to the next level.

Prior to concluding this chapter with a closer look at the research questions of this study, I summarize the relevant studies already conducted in Singapore, which establish further impetus for the current study.

The Language Context in Singapore

Like many other multicultural societies, families in Singapore vary in terms of the languages used at home, which brings to mind the heterogeneity of bilingual learners (e.g., Hammer et al., 2014). As mentioned earlier, English is the main medium of instruction in school. Chinese (Mandarin) is a logographic language, and in Singapore, it may be taught using an alphabetized form (Hanyu Pinyin). In contrast, Bahasa Melayu is an alphabetic language, but with a more transparent orthography as compared to English. As previously discussed, it is likely

that the similarity between the writing system of an additional language (in this case the similarity of Bahasa to English) may facilitate the literacy acquisition of the bilingual child (Ziegler & Goswami, 2005).

On the other hand, most children in Singapore are exposed to a nonstandard variety of English in addition to their primary language. Colloquial Singapore English is characterized by nonstandard grammar and morphology (e.g., Alsagoff, 1998). This may also lead to confusion regarding referral for possible language deficits such as language impairment, as several common features of nonstandard English have been shown to overlap with deficit markers for atypical language development in monolingual English speakers, including the omission of plural markers and regularization of irregular past tense (e.g., Conti-Ramsden, Botting, & Faragher, 2001).

Previous research conducted in Singapore has also concluded that PA significantly predicts both reading accuracy and reading comprehension skills for girls in Primary One (Tan, Poon, & Rickard Liow, 2013). Yet although PA is regarded as a language-general ability, cross-language application depends on the similarity between the phonological structure of the languages to which the bilingual child is exposed (Yeong & Rickard Liow, 2012). Specifically, due to the nature of the difference between English and Chinese, where the main unit of concern is the syllable, Yeong and Rickard Liow's (2012) study provided evidence that predominantly Mandarin-speaking children do not begin to develop phoneme awareness until they are exposed to more oral and written English in kindergarten.

In another set of studies, Dixon (2010) demonstrated that the overall mean scores for a sample of almost 300 Singaporean K2 pupils were, on average, 1.5 SD lower than U.S. norms on vocabulary and .58 SD lower on PA, but .86 SD higher on single-word reading. These findings challenged the assertion that learning an alphabetic script through only logographic methods leads to slower reading acquisition. This study also demonstrated that PA plays a greater role in predicting reading skills as compared to vocabulary. In another article, the same researcher and her colleagues compared the Chinese, Malay, and Tamil speaking students in Singapore, and concluded that (a) English vocabulary predicted concurrent English PA, and (b) the specific ethnic language of the child predicted concurrent English PA. Specifically, the Malay-speaking children performed the best of the ethnic language groups (Dixon, Chuang, & Quiroz, 2012). However, in both of these studies, data were collected only at one point in time. Also, it was not made entirely clear how the information on the home language background was collected, and the researchers did not distinguish between the English-dominant children, and the families who spoke mostly the ethnic language to their child.

The current study endeavored to shed more light on the above-mentioned debate about the phonological processing abilities of young children, and its relationship to the amount of English language exposure at home. In addition, it sought to improve upon some of the weaknesses of previous studies by providing data at two time-points for each child and including an LBQ to better understand the child's home language background.

The Current Study

I aimed to evaluate whether a dynamic assessment measure performs better than a traditional standardized measure in identifying children with poor word reading outcomes. My study was designed to contribute to the existing literature because it was conducted in a multicultural and multilingual society that has a bilingual education policy. Taking the cue from

the studies by Spector (1992), Bridges and Catts (2011), and Petersen and colleagues (2016), I chose to focus on younger children (ages 4 to 5) because children in Singapore typically learn to read at a very young age, and the aim of the study was to predict whether children will have later reading difficulty, even before they start to fall behind. I drew from the rationale of Cunningham and Carroll (2011), who involved younger children ages 4 to 6 at the first 2 years of formal schooling in the UK. They found significant effects of both age and schooling on the dynamic measure of phoneme awareness and tests of early literacy. This study emphasized the importance of assessing children at the optimum age.

In addition, it was deemed important to select a sample that varied in terms of proficiency with language and reading, and compare their performance on static and dynamic measures. Although the focus in this study is on PA measures, other aspects of reading and language, such as letter recognition, expressive and receptive vocabulary may be helpful in distinguishing (a) which constructs predict the most variance in later reading ability in bilingual children, and (b) which sorts of measures, dynamic or static, are the most helpful in predicting later reading ability. The language scores would be useful control variables, because of the close relation between language and reading (e.g., Catts, 1991; Howard et al., 2014). As with most skills, a longitudinal study design would yield the most promise in providing information about predictive validity.

Similar to the field of developmental psychopathology, conditions such as mental illness, developmental disorders, and learning disabilities have multiple pathways. In some cases, the same risk and protective factors may lead to, or be associated with different outcomes, known as the principle of multifinality. Conversely, the principle of equifinality also applies, where multiple causes could lead to the same outcome (Hinshaw, 2017). Using this analogy, assessing the PA of bilingual children at an appropriate time of their development and choosing suitable assessment tools are of utmost importance.

Having provided the rationale for the current study, the following chapter provides information about the research methodology. Chapter 3 contains details about the sample, measures used, and procedures for data collection.

Chapter 3: Research Methodology

The main aim of the study was to identify which is the best predictor of later reading ability in a group of bilingual preschool children in Singapore. In this chapter, I discuss the demographics of the participants, describe the measures employed in the study and the procedure for data collection and analyses that are directly linked to the research questions.

Preschool Context of the Participants

Children attending their first year of kindergarten (K1), the calendar year in which they turn 5 years old, were recruited through their kindergarten and childcare centers in Singapore. One childcare provider assigned five of their centers to participate in the study, and six other principals and center managers agreed for parent permission forms to be distributed to the parents of children in the centers. A total of 11 different preschool centers across the island nation of Singapore were thus recruited and participated in the study. By selecting preschool centers from different parts of the country, particularly those utilizing a variety of curriculum and instruction methods, this sample was deemed a good representation of the different socioeconomic and home language backgrounds in Singapore.

The 11 centers consisted of two church kindergartens, two full-day childcare centers (one of which serviced the Malay community), and seven centers from two kindergartens operating under a large chain. There was a relatively wide variation in terms of the cost of attending the preschool programs, demonstrating the range in family SES. For example, one childcare center provided services only to families with lower income levels and therefore most parents were heavily subsidized, while others cost up to S$9,460 per year[1] before any government subsidies or financial assistance. As a point of comparison, one of the half-day kindergartens cost S$5,460 per year.[2] Seven of the eleven preschool centers offered full-day (7 am to 7 pm) childcare programs, whereas the children in the other four centers attended half-day programs (either 3 or 4 hours in the morning or afternoon). Table 1 displays the number of children from each center, along with the location of the center, and whether it ran a full-day childcare or half-day kindergarten program.

Table 1
Distribution of Sample by Center and Location

Center	Location in Singapore	Type of program	Number of participants
SKC	Northeast	Full-day childcare	10
AVC	Northeast	Full-day childcare	4
BCS	East	Full-day childcare	13
YEC	East	Full-day childcare	3
TLK	East	Half-day kindergarten	14
BKK	East	Half-day kindergarten	12
SMC	Central	Full-day childcare	10
JW7	West	Full-day childcare	10
JW2	West	Full-day childcare	5
WC2	West	Half-day kindergarten	14

[1] Approximately $7,200 USD.
[2] Approximately $4,200 USD.

WC8	West	Half-day kindergarten	4
		Total:	99

Participants

The initial sample was comprised of 99 students (56 girls and 43 boys), with ages ranging from 4 years 8 months to 6 years 3 months (*M* = 63.31 months, *SD* = 3.87 months). Children who had previously been identified by their parents or kindergarten teachers as having special learning needs which required additional support in the form of Singapore's Early Intervention Program for Infants and Children (EIPIC) were excluded from this study. Otherwise, the sample was selected based on parents who returned the parent permission forms in the Kindergarten 1 classes from the identified schools.

In terms of home language and ethnicity, 75 children (75.8% of the sample) were English-Chinese bilinguals, reflecting the ethnic mix in Singapore, which is majority Chinese ethnicity (74.3% of the citizen population; Singapore Department of Statistics, 2017). Twelve children were English-Malay bilinguals and were therefore administered the Malay version of the *Bilingual Language Assessment Battery* (*BLAB*). Eighteen parents reported speaking a language other than English, Mandarin, or Malay in the home, as depicted in Table 2. Some children were exposed to more than two languages at home (e.g., Vietnamese and Mandarin). This in part reflects the immigration trends in Singapore, as a large percentage of the population are non-residents. Of the nation's total population of 5.61 million in 2017, 3.97 million were residents, which include citizens and permanent residents (Singapore Department of Statistics, 2017).

Table 2
Language Variety Children in the Sample Were Exposed to at Home

Language spoken at home, other than English, Mandarin, or Malay	Number of children
Chinese dialect (including Cantonese and Teochew)	3
Tamil	3
Bengali	2
Hindi	2
Malayalam	2
Myanmar	2
Vietnamese	2
Tagalog	1
Bahasa Indonesian	1
Total	18

From the LBQ, parents were asked for specific demographic information, including the type of housing in which they lived (e.g., one- or two-bedroom apartment) and highest parental education level. The information obtained for highest education level is shown in Figure 1. Following the example of previous studies which utilize information about parental education and income level (Dixon et al., 2012; Sirin, 2005), data from these two items were combined to create a single item to represent each family's SES. In the current study, because parents were not asked information about their income level, housing type was used as a proxy for income level. The SES variable was created such that parents' education level was given the same

weightage as the housing type. For the parents who completed the questionnaires, three responses were missing regarding the father's education, but an SES variable could still be constructed.

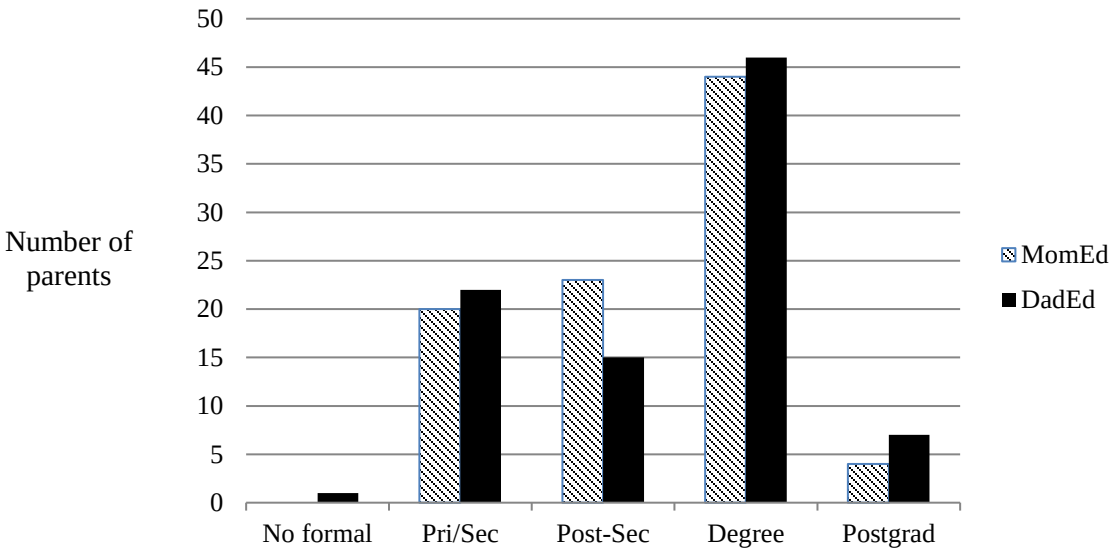

Figure 1. *Parents' education level.*

As this was a longitudinal study conducted over two time-points across 4 to 6 months, there was some attrition, the parent of one student withdrew consent midway through the study, three students were no longer in that preschool center during the follow-up assessment period, two were out of the country for an extended period of time, and one student was absent from school that day due to illness. Therefore, the final sample was comprised of 92 students. T-tests were conducted to compare the scores of the seven children who were not involved in the follow-up assessment. No significant differences were found for the pre-test scores between the children who dropped out of the study compared to the children who remained in the study.

Measures

The following instruments were administered at two time-points toward the end of the children's first year in kindergarten (Time 1), and then in the second quarter of their second kindergarten year (Time 2). Single-word receptive vocabulary was measured in two languages to measure language proficiency. A variety of phonological processing measures were also used, including a standardized test of PA, phonological memory, and RAN, as well as a dynamic assessment of PA. Letter and word identification measures were used to assess the children's letter and word knowledge. Table 3 displays a summary of the measures administered at the two time-points.

Table 3
Summary of Assessment Measures

Assessment	What it measures	Time-point
Language Background Questionnaire	Language dominance based on parent/teacher report	Time 1
Bilingual Language Assessment Battery (*BLAB*): Receptive Vocabulary	Language proficiency in English and Mandarin or Malay	Time 1
Clinical Evaluation of Language Fundamentals Preschool – Second Edition (*CELF* Preschool-2)	Language proficiency in English	Time 1
Comprehensive Test of Phonological Processing – Second Edition (*CTOPP-2*)	Phonological awareness (static assessment)	Times 1 & 2
Dynamic phonological awareness task	Phonological awareness (dynamic assessment)	Time 1
York Assessment of Reading for Comprehension (*YARC*)	Letter identification/ Word reading	Time 1
Woodcock-Johnson – Third Edition (WJ-III)	Letter identification/ Word reading	Time 2

Language measures. A parent questionnaire was administered to better understand each child's home language background, focusing on the language(s) spoken at home, and to gain an understanding of their language dominance. In addition, standardized measures were utilized to ascertain their language proficiency.

Amount of English spoken at home. This demographic information was obtained from an LBQ, which was adapted from the *BLAB* – English: Preschooler's Parent Report Form (Pua, Lee, & Rickard Liow, 2013), as well as an LBQ that was part of another group of researchers' Bilingual English Spanish Oral Language Screening (Bedore et al., 2012). The Chinese version of the LBQ was used by Pua, Lee, and Rickard Liow (2017), and the additional questions from the questionnaire by Bedore and colleagues (2012) were translated into Chinese by the researcher and cross-checked by another Singaporean researcher. The English version of the questionnaire is included in Appendix A. Only English and Chinese versions of the forms were made available to parents because all of the parents could read either English or Chinese, and the Malay-speaking parents and those who spoke other languages at home were also comfortable reading English.

In the forms, parents were asked to indicate what language the mother and father used with the child, and then to estimate the amount of time, in percentage, they spent using those languages. Parents were also asked about the language(s) used with each other, as well as the language(s) the maternal and paternal grandparents, and any live-in domestic helper, or other caregiver, use with the child. Another question asked who looks after the child most of the time. This was done to take into account the childcare situation in Singapore. Language dominance was assessed in terms of whether the child is a Balanced Bilingual (hearing and using English between 40 and 60% of the time at home), English-dominant, or L2-dominant. If there was any uncertainty as to how to classify the parents' response, the researcher also looked at their responses in the second half of the questionnaire regarding the child's language proficiency. Questions in this section included which language the parent thought their child spoke the best,

when the child was first exposed to that language, and his or her proficiency in terms of vocabulary, speech, sentence production, grammar, and comprehension, in both English and the child's strongest language other than English. Three examples are given below to demonstrate how the classifications of English-dominant, L2-dominant, or Balanced Bilingual were made.

In the first case, one mother indicated that she used English 70% and Malay 30% of the time with her child, while her husband used English 60% and Malay 40% of the time. She indicated that the parents used English 50% and Malay 50% of the time when speaking to each other. The maternal grandparents looked after the child most of the time, and used English 50% and Malay 50% of the time, while the paternal grandparents used Malay 100% of the time with the child. From this profile, this child was classified as a Balanced Bilingual.

For the second case, both parents used Mandarin 80% and English 20% of the time with the child, and Mandarin 100% of the time with each other. Paternal and maternal grandparents were reported to use Mandarin 100% of the time with the child, and the child's mother was the main caregiver. Therefore, this child was considered L2 (Mandarin) dominant.

For the last example, the mother used English 90% of the time and Mandarin 10% of the time with the child, while the father used English 100% of the time. With each other, parents used English 50%, Mandarin 40%, and Chinese dialect (Teochew/Hokkien) 10% of the time. The maternal grandparents were reported to use English 50% and Mandarin 50% of the time with the child, while the paternal grandparents used Mandarin 100% of the time with the child. This child had a live-in domestic helper who was the main caregiver, and used English 100% of the time with the child. Based on parents' responses on this questionnaire, this child was considered English-dominant.

A total of 83 parents returned the LBQ, with 7 missing data. For one childcare center that only caters to families with a lower SES, the executive director decided that it would be easier for the teacher to fill in the questionnaire instead of the parents. Therefore, data for 9 students were from the teacher instead of the children's parents. Based on the 92 responses of the parents/teacher and utilizing the criteria stated above, 27 children were classified as English-dominant, 34 were considered Balanced Bilingual, and 31 were in the L2-dominant category.

Bilingual Language Assessment Battery: Receptive Vocabulary. The *BLAB*: Receptive Vocabulary (Rickard Liow & Sze, 2009) is a computerized auditory picture-matching task developed in Singapore that measures single-word receptive vocabulary. The test contains three practice items on which feedback is given and 80 test items. For each item, the child is shown four pictures, and asked to point to the picture that matches the word he or she hears on the computer. The parallel forms of the tests (i.e., English and Mandarin or English and Malay) were used in this study. Each child was assessed in English, as well as Mandarin or Malay depending on their first and second language. The order of administration in the respective languages was randomly counter-balanced within gender and language background.

Clinical Evaluation of Language Fundamentals Preschool – Second Edition. The Word Structure, Expressive Vocabulary, and Recalling Sentences subtests from the *Clinical Evaluation of Language Fundamentals Preschool* (*CELF*) – Second Edition (Wiig, Secord, & Semel, 2004) were administered to measure the child's expressive language ability in English. This test was developed in the United States for children aged 3 to 6. The Word Structure subtest assesses the child's ability to apply word structure rules (morphology), including the use of *–ing* words, prepositions, and tense markers. The Expressive Vocabulary subtest assesses their single-

word expressive vocabulary, requiring them to label people, objects, and actions. For the Recalling Sentences subtest, the child is asked to repeat a sentence exactly after the examiner. These three subtests were converted into z-scores for the current sample, and combined into one composite measure to reflect expressive language in English.

Literacy measures. In addition to the language measures, four assessment tools were administered to evaluate each child's letter and word knowledge, PA and other aspects of phonological processing.

York Assessment of Reading for Comprehension. The Letter Sound Knowledge and Early Word Recognition subtests from the Early Reading component of the *York Assessment of Reading for Comprehension* (*YARC*; Hulme et al., 2009) were administered to assess the child's letter knowledge and word reading skills. This test was developed in the UK for children aged 4 to 7. The Letter Sound Knowledge subtest consists of the 26 letters of the alphabet, as well as six vowel and consonant digraphs. The child is given credit for either the sound of the letter or the letter name (except for the digraphs). The Early Word Recognition subtest consists of 30 common words, some of which can be sounded out and others of which are considered sight words. The scores from these two subtests were combined to create one score, representing the child's baseline knowledge in recognizing letters and words.

Woodcock-Johnson – Third Edition. The Letter-Word Identification (LWI) and Word Attack subtests from the *Woodcock-Johnson* – Third Edition (*WJ-III*; Woodcock, Mather, McGrew, & Schrank, 2007) were administered as the outcome variable for letter and word reading and pseudoword decoding, respectively. The pseudoword decoding or nonword reading task can be seen to be a pure measure of grapheme–phoneme recoding skills (Vellutino et al., 2004).

Comprehensive Test of Phonological Processing – Second Edition. The *Comprehensive Test of Phonological Processin*g – Second Edition (*CTOPP-2*; Wagner, Torgesen, Rashotte, & Pearson, 2013) is a standardized PA task developed in the United States for children aged 4 to 6. The Elision, Blending Words, and Sound Matching subtests from the *CTOPP-2* provided a measure of the child's static ability in PA. The child is asked to break up words into smaller parts, put sounds together, and identify words that begin or end with the same sound. The Memory for Digits and Nonword Repetition subtests provide a measure of the child's ability in phonological memory, where the child is required to repeat a series of numbers or a nonword immediately after the recording. The Rapid Color Naming and Rapid Object Naming subtests provide a measure of RAN ability. This procedure involves the child having to name a series of 36 colors or objects as quickly as she or he can without making mistakes. As with the *CELF*, the scores from the relevant subtests were converted into z-scores, and combined into three composite measures to reflect PA, phonological memory, and RAN.

Dynamic phonological awareness task. As used in the study by Spector (1992), this is a phoneme segmentation task, which was based on the Yopp-Singer test of phoneme segmentation (Yopp, 1988). In this task, if the student is unable to segment a word correctly, the examiner moves the child through a series of standardized graduated prompts until he or she produces the correct segmentation. Graduated prompts include breaking down the instruction, and then later, modelling segmentation of the word by using physical representations of the sounds in a word. Each child attempted a maximum of 12 items: four consonant-vowel (CV) words (i.e., *say, pie, we, two*), four vowel-consonant (VC) words (*age, eat, egg, if*), and four consonant-vowel-

consonant (CVC) words (*leg, feet, page, rice*). Following Spector's (1992) protocol, testing was discontinued for the five children who were unable to produce a correct segmentation after all seven prompts (including the last three prompts, which required imitation only). The child was considered successful if he or she responded correctly to any of the prompts. However, the maximum score was given only if the child could produce the desired response without any prompts or scaffolding. If they needed one prompt, they were given one fewer point, and so on. Therefore, the procedure for scoring reflected the degree of independence that a student achieved in performing the task. The various prompts provided are included in Appendix B. The alpha coefficient for this scale was 0.93.

Procedures

Ethics approval was obtained from the University of California, Berkeley Institutional Review Board (IRB). In addition, a reliance agreement was signed with the San Francisco State University (SFSU) IRB, which meant that no further review was needed by the SFSU IRB. Informed consent was obtained from all parents of the children included in the study, and the child's verbal assent to participate was also obtained. The children were told that if they did not want to participate in the activities, they could discontinue testing at any time and go back to their classroom activities. However, all of the children completed the given assessments. As a small reward for completing the activities, they were given a sticker after each session.

The baseline assessment battery was administered from September to November 2017 and consisted of a variety of tasks designed to assess the children's receptive and expressive language skills, phonological processing skills, and initial letter and word knowledge. Assessments were conducted during three visits per child, which took about 20 to 30 minutes per session. All assessments were conducted in a quiet space in the preschool on an individualized basis. The assessments were carried out by the researcher, who is a registered psychologist, and one research assistant, a learning support facilitator who has 15 years of experience working with preschool children. The research assistant was trained by the principal investigator to administer the *BLAB*, and the dynamic assessment task with a third of the children. After the training period, the two examiners observed each other carry out the dynamic assessment task with two children each, and scored the task independently in order to ensure reliability in test administration and scoring. The order of administration of the standardized and dynamic PA tasks was randomly counter-balanced so that half of the children encountered the standardized test first, while the other half were given the dynamic test first. Counter-balancing was conducted within gender and language background of the children, which helped to balance out any possible practice effects from either task. Four to 6 months later, in March 2018, follow-up assessments were conducted with the same group of children. This battery of assessments took approximately 30 minutes per child.

Research Design and Data Analysis

In order to better document any differences and clarify the bilingual advantage for the development of PA, I first compared the phonological processing skills of the bilingual children based on their language skills/exposure to English using regression analyses. I asked whether the amount of English spoken at home as well whether children's performance on tests of English language contributed to variance in PA performance in English. For this research question, the independent variable was the amount of English spoken at home based on the parents' responses

to an LBQ. The participants were divided into three groups based on their home language background: English-dominant, L2-dominant, or Balanced Bilingual.

To answer my second research question, hierarchical linear regression was used to analyze the data, with the *WJ-III* Letter/Word Identification (LWI), Word Attack, and the *CTOPP-2* PA composite score serving as the outcome variables. Because there were three different outcome variables, three separate sets of analyses were employed to answer this research question. I used stepwise regression to identify the contribution of the dynamic measure, beyond that explained by the other variables and the static PA measure. The control variables in the first two models were as follows: child's age, family SES, home language dominance group, receptive language scores, expressive language scores in English, prior letter/word reading scores, and the number of weeks in between the two testing sessions. These measures were added as my first block of variables into the model, followed by the standardized PA scores. Finally, the dynamic PA task was added to the model in order to assess how much added variance in the outcome variable this dynamic measure could explain.

Finally, to incorporate a qualitative component to the research and understand the story behind the numbers, I asked whether specific students were representative or prototypical in terms of their literacy development and performance on the targeted assessments. In particular, I focused on the aspect of home language background, and investigated how well this variable would predict the children's performance on the language and literacy assessments. To do so, I divided the assessments into three broad categories: the General Language measures (i.e., the *BLAB* and the *CELF*), the PA measures (i.e., the *CTOPP-2* and the dynamic assessment task), and the Reading measures (i.e., the *YARC* and the *WJ-III*). I plotted each child's scores relative to the sample on a graph, and identified children who were high in all three, low in all three, or had a pattern of strengths and weaknesses (e.g., high in two aspects and low in one, or low in two aspects and high in the other) based on these three broad areas. For this analysis, I selected six students who exhibited different profiles on the various assessment measures and utilized these profiles to illustrate the complexities of interpreting the results when children from diverse linguistic backgrounds are involved.

Chapter 4: Results

This chapter presents the findings from the assessment battery administered to the children at both time-points in order to identify the best predictors of later reading. Descriptive statistics and preliminary analyses, which check for outliers and examine if the obtained scores are normally distributed, are presented initially prior to outlining the research questions and corresponding analyses from the various data sources. Although most of the data analysis methods are quantitative, qualitative methods were employed to address Research Question Three. For this research question, the profiles of six different children who were representative of the larger sample were analyzed. Thus, a mixed-methods approach (e.g., Johnson, Onwuegbuzie, & Turner, 2007) was employed to provide a more descriptive overview and perspective regarding the language and literacy profiles of the bilingual sample.

As described previously, the research questions are as follows:

1. Do typically developing preschool students in Singapore who have more exposure to English and better developed English language skills perform significantly better on standardized tests of phonological awareness in English, compared to students who have less exposure to English and poorer English language skills?
2. Adjusting for language measures, current letter and word knowledge, and the family's socioeconomic level, does a dynamic test of phonological awareness contribute additional variance above and beyond an earlier standardized measure of phonological awareness in predicting later phonological awareness, word reading outcomes, and pseudoword decoding?
3. Are specific students prototypical in terms of literacy development and performance on the targeted assessments? In particular, how well does home language background predict the children's performance on the language and literacy assessments?

Preliminary Analyses

As a first step of data analysis, the descriptive statistics of the scores were inspected. Scores on the *CELF* and *CTOPP* were converted to z-scores and combined to produce the variables that were used for subsequent analysis. In addition, the Letter Sound Knowledge and Early Word Recognition scores from the *YARC* were combined to form a single Time 1 letter/word reading score. Because the *WJ-III* Word Attack score distribution was positively skewed instead of being normally distributed, these data were transformed to reflect two groups: those with Word Attack skills (n = 53), meaning that they were able to read at least one of the pseudowords correctly, and the children who had yet to acquire Word Attack skills (n = 39). Means and standard deviations for each measure are presented in Appendix C.

Comparing Sample to the Normed Sample

As mentioned previously in the first two chapters, taking into account cultural and linguistic differences, one cannot simply adopt the norms from standardized tests if they have been developed in a different country or setting. Thus, many researchers have strived to develop their own culturally-sensitive tests and norms, and many clinicians in various settings find it difficult to rely on standardized test norms. As a point of comparison, I conducted one sample t-tests on the *CELF* and *CTOPP* subtests in order to demonstrate this point. Results are shown in Table 4.

Table 4
One Sample T-Tests Comparing Scaled Scores to Standardized Sample

	Mean (SD)		t-value
	Current sample	Standardization sample	
Time 1			
CELF Word Structure	5.17 (2.99)	10 (3)	-15.99***
CELF Expressive Vocabulary	7.99 (2.80)	10 (3)	-7.10***
CELF Recalling Sentences	8.24 (2.66)	10 (3)	-6.54***
CTOPP Elision	8.84 (3.09)	10 (3)	-3.73***
CTOPP Blending Words	8.63 (2.57)	10 (3)	-5.26***
CTOPP Sound Matching	10 (2.93)	10 (3)	.00
CTOPP Digit Recall	11.69 (2.66)	10 (3)	6.30***
CTOPP Nonword Repetition	7.86 (1.93)	10 (3)	-11.01***
CTOPP Rapid Naming – Colors	11.69 (3.01)	10 (3)	5.57***
CTOPP Rapid Naming – Objects	11.88 (2.70)	10 (3)	6.90***
Time 2			
CTOPP Elision	9.53 (2.80)	10 (3)	-1.60
CTOPP Blending Words	8.29 (2.65)	10 (3)	-6.18***
CTOPP Sound Matching	10.43 (3.41)	10 (3)	1.22

* $p < .05$. ** $p < .01$. *** $p < .001$.

Even in my sample of 99 students, several significant (and in some cases large) differences were found between the sample mean and the scale score of 10, the mean of the standardization sample. Specifically, as might be expected, there were significant differences on all three *CELF* subtests, and the *CTOPP-2* PA Elision and Blending Words subtests. The Singapore sample was also significantly lower on Nonword Repetition. On the other hand, the Singapore sample was better on Digit Repetition, and both RAN subtests. This clearly demonstrates that it is not suitable to use the norms without further consideration of the children's cultural and language background. Therefore, for subsequent analyses, the *CELF* and *CTOPP-2* scores were transformed into z-scores for this particular sample.

Correlations Among Measures

The correlation matrix found in Table 5 shows the relation between the variables measured at both time-points. As can be seen, there is a very high correlation between the *CTOPP* PA variable and the dynamic assessment variable ($r = .82$, $p < .001$), indicating significant overlap between these two measures. It was also noted that the *CTOPP* PA composite measure correlated more highly with all other measures than did the dynamic assessment measure, except for *BLAB* in Mandarin/Malay, suggesting that it is a more robust measure in this battery.

Table 5
Correlation Matrix of Variables Measured

	Time 1						Time 2		
	1	2	3	4	5	6	7	8	9
Time 1									
1. *BLAB* English	1.00								
2. *BLAB* L2	.20	1.00							
3. *CELF*	.67***	-.01	1.00						
4. PA	.53***	.28**	.58***	1.00					
5. DA	.45***	.29**	.43***	.82***	1.00				
6. *YARC*	.42***	.27*	.58***	.76***	.59***	1.00			
Time 2									
7. PA2	.47***	.27*	.58***	.90***	.81***	.70***	1.00		
8. LWI	.42***	.25**	.56***	.77***	.60***	.94***	.69***	1.00	
9. WA	.41***	.21	.55***	.75***	.56***	.76***	.73***	.87***	1.00

Note. *CELF* = English expressive language; PA = *CTOPP* Phonological Awareness; DA = Dynamic Assessment; *YARC* = Letter/Word Reading; LWI = *WJ-III* Letter-Word Identification; WA = *WJ-III* Pseudoword Decoding.
* $p < .05$. ** $p < .01$. *** $p < .001$

These simple correlations do not take into account the confounding influences among the various measures. Multiple regression analyses, described below, permitted an estimate of the independent effects of each Time 1 variable, holding constant the effects of all remaining variables.

Before conducting further analyses, I looked closer at the descriptive statistics using the three groups of children (English-dominant, Balanced Bilingual, and L2-dominant) based on parents' responses on the LBQ. Accordingly, I investigated whether these three groups could be easily distinguished on the various other measures used in the study. The means of the language and PA measures by group are shown in Table 6 below.

Table 6
Means and Standard Deviations by Language Dominance Group

Measure	English-dominant (n = 27)	Balanced Bilingual (n = 35)	L2-dominant (n = 30)	ANOVA F (df)
Time 1				
Rec. English	46.67 (8.31)	43.26 (5.98)	40.07 (9.14)	5.07 (2, 89)**
Rec. L2	33.96 (7.13)	40 (5.79)	41.39 (10.08)	7.04 (2, 79)**
z_Exp. English	.62 (.77)	.14 (.72)	-.49 (.77)	15.95 (2, 89)***
DA	42.68 (15.75)	44.09 (17.56)	35 (17.78)	2.40 (2, 85)
z_CTOPP PA	.15 (.88)	.20 (.82)	-.30 (.84)	3.25 (2, 89)*
Letter/Word Rdg	40.15 (13.84)	38.17 (12.91)	33.47 (12.49)	2.01 (2, 89)
Time 2				
z_CTOPP PA	.21 (.76)	.19 (.81)	-.31 (.87)	3.77 (2, 84)*
Letter/Word Rdg	28.68 (13.17)	25.97 (10.20)	22.45 (10.45)	2.11 (2, 84)

Pseudoword Rdg	10.64 (8.64)	7.55 (5.02)	6.93 (6.28)	2.38 (2, 84)

* $p < .05$. ** $p < .01$. *** $p < .001$

To summarize, I found that there was indeed a significant difference on the measures of expressive English, and receptive language both in English and in Mandarin or Malay. However, the relations were not always straightforward. The *CELF* scores were best in distinguishing between all three groups, with the English-dominant group having the highest scores, the L2-dominant group having the lowest scores, and the Balanced Bilinguals in between. On the English version of the *BLAB*, the only significant difference was between the English-dominant and the L2-dominant groups. However, for the Mandarin and Malay versions of the *BLAB*, English-dominant was the only group with significantly lower scores than the other two groups, and there was no significant difference between the Balanced Bilingual and L2-dominant groups.

When turning to phonological awareness scores, there was a significant difference in the standardized PA scores at both time-points based on language dominance. Specifically, the L2-dominant group had significantly lower PA scores than the other two groups. The situation becomes slightly more complex when including other measures into our regression, as can be seen when addressing Research Question 1.

Research Question 1

The first research question was as follows: Do typically developing preschool students in Singapore who have more exposure to English and better developed English language skills perform significantly better on standardized tests of phonological awareness in English compared to students who have less exposure to English and poorer English language skills?

I used linear regression to evaluate if the language measures (i.e., home language dominance group, *BLAB*, and *CELF* data) significantly predicted baseline standardized PA scores (see table 7).

Table 7
Multiple Regression Analyses Predicting CTOPP Phonological Awareness

	CTOPP Phonological Awareness		
Predictor variables	*B*	95% CI	*t*
Receptive English	0.03 (0.01)	[0.01, 0.05]	2.55*
Expressive English	0.46 (0.12)	[0.22, 0.69]	3.84***
Home language dominance			
- Balanced Bilingual	0.37 (0.18)	[0.01, 0.73]	2.06*
- L2-dominant	0.26 (0.21)	[-0.16, 0.67]	1.22
R^2 (Adj. R^2)		.41 (.38)	
F		15.10	

Note. CI = confidence interval. Standard errors are in parentheses.
* $p < .05$. ** $p < .01$. *** $p < .001$.

There was indeed a significant impact of these factors on the PA scores. Specifically, even after adjusting for home language background, both receptive and expressive scores in English contributed a significant amount of variance to PA scores (for *BLAB*Eng, $t = 2.55$, $p = .01$, and for *CELF*, $t = 3.84$, $p < .001$). The regression coefficient indicates that adjusting for receptive language in English, and the child's home language background, every unit increase in

the standardized score on the *CELF* resulted in an estimated mean of 0.46 increase in standardized *CTOPP* PA scores.

Conversely, adjusting for receptive and expressive language skills in English, home language background also contributed to variance in PA scores. Specifically, there was a significant difference between the Balanced Bilingual group and the English-dominant group (t = 2.06, p = .04). Interestingly, the regression coefficient indicates that, adjusting for the child's expressive and receptive language scores in English, a child from the Balanced Bilingual group had an estimated mean of 0.37 standardized *CTOPP* PA scores higher than a child from the English-dominant group. There were no differences between the English-dominant and the L2-dominant groups, or the Balanced Bilingual and the L2-dominant groups.

Research Question 2

The second research question was as follows: Adjusting for language measures, current letter and word knowledge, and the family's socioeconomic level, does a dynamic test of phonological awareness contribute additional variance above and beyond an earlier standardized measure of phonological awareness in predicting later phonological awareness, word reading outcomes, and pseudoword decoding? This approach required separate analyses, one for each of the three dependent measures administered at Time 2: LWI, Word Attack, and the *CTOPP* PA composite score. I used stepwise regression to identify the contribution of the dynamic measure, beyond that explained by the other variables and the static PA measure. The results of these regression models are displayed in Tables 8 through 11.

Predicting letter/word reading at Time 2. For the first regression model, the data were analyzed to investigate the predictive ability of the dynamic phoneme segmentation measure. I used hierarchical linear regression to identify the Time 1 measure that best predicted LWI at Time 2. The covariates in the first two models were as follows: child's age, family SES, home language dominance group, receptive language scores, expressive language scores in English, prior letter/word reading scores, and the number of weeks in between the two testing sessions. These measures were added as my first block of variables into the model, followed by the standardized PA scores. Finally, the dynamic PA task was added to the model in order to assess how much added variance in the outcome variable this dynamic measure could explain.

Table 8
Multiple Regression Analyses Predicting LWI

	Model 1	Model 2	Model 3
Step 1			
Age	-0.05 (0.11)	-0.03 (0.11)	-0.07 (0.11)
Family SES	0.02 (0.27)	-0.002 (0.27)	-0.25 (0.27)
Home language group			
- Balanced Bilingual	-1.07 (1.20)	-1.32 (1.17)	-1.78 (1.19)
- L2-dominant	-0.49 (1.26)	-0.65 (1.26)	-1.31 (1.33)
Receptive language	0.03 (0.03)	0.02 (0.03)	0.03 (0.03)
Expressive language (English)	0.51 (0.60)	0.35 (0.62)	0.54 (0.67)
Time 1 letter/word reading	0.76 (0.04)***	0.72 (0.05)***	0.72 (0.06)***
Number of weeks in between testing	0.11 (0.19)	0.12 (0.19)	0.12 (0.21)
Step 2			
CTOPP Phonological Awareness		0.87 (0.74)	1.61 (1.11)

Step 3			
Dynamic Assessment			-0.06 (0.05)
Total R^2	.88	.88	.88

Note. Table reflects regression coefficients. Standard errors are in parentheses.
* $p < .05$. ** $p < .01$. *** $p < .001$.

For the LWI outcome measure, the earlier letter/word reading measure itself took away the bulk of the variance explained ($t = 12.48$, $p < .001$), to the extent that no other variable was significant in the model. The regression output indicates that for every additional letter or word the child knew at the first assessment, s/he was expected to know an additional .72 words on the *WJ-III* LWI outcome assessment. Altogether, this model explained 88.4% of the variance in word reading outcome measures 4 to 6 months later.

However, replicating Spector's (1992) data analytic procedures, I included only the 36 children identified as "non-readers" during the first assessment, by which I defined as being able to read fewer than four words on the *YARC*, the Time 1 letter/word reading measure.

Table 9
Multiple Regression Analyses Predicting LWI With Only Non-Readers

	Model 1	Model 2	Model 3
Step 1			
Age	-0.10 (0.14)	-0.10 (0.11)	0.05 (0.12)
Family SES	0.32 (0.37)	0.35 (0.30)	0.72 (0.39)
Home language group			
- Balanced Bilingual	-0.32 (1.41)	-1.18 (1.52)	-0.75 (1.60)
- L2-dominant	-1.05 (1.43)	-1.69 (1.32)	-1.17 (1.54)
Receptive language	0.02 (0.04)	0.01 (0.03)	0.02 (0.03)
Expressive language	0.40 (0.86)	0.50 (0.99)	-0.54 (0.84)
Number of weeks in between testing	0.20 (0.28)	0.01 (0.29)	-0.19 (0.31)
Step 2			
CTOPP Elision		-0.91 (0.96)	-1.80 (1.18)
CTOPP Blending Words		-0.20 (1.27)	-0.52 (0.82)
CTOPP Sound Matching		2.01 (0.90)*	0.76 (1.04)
Step 3			
Dynamic Assessment			.16 (0.07)*
Total R^2	.23	.41	.52

Note. Table displays regression coefficients. Standard errors are in parentheses.
* $p < .05$. ** $p < .01$. *** $p < .001$.

In this case, putting the three *CTOPP* PA measures in separately, and still adjusting for age, number of weeks in between the two assessment sessions, family SES, language scores, and home language group, the dynamic assessment task was indeed the only variable significant in predicting later LWI scores ($t = 2.33$, $p = .03$), explaining an additional 11% of the variance in later LWI in this smaller sample. Scores should be interpreted with caution due to the small sample size.

Predicting pseudoword decoding. The Word Attack measure was transformed to a categorical variable, defined as those children who had Word Attack skills and those who did not. Subsequently, logistic regression was used instead of linear regression to determine the Time 1 variables which would predict the odds of having decoding skills.

Table 10
Logistic Regression Results for Pseudoword Decoding

	Odds ratio	95% CI
Age	0.96	[0.78, 1.18]
Family SES	0.90	[0.57, 1.44]
Home language group		
- Balanced Bilingual	0.28	[0.05, 1.74]
- L2-dominant	0.48	[0.06, 3.62]
Receptive language	0.99	[0.95, 1.04]
Expressive language	0.55	[0.19, 1.62]
Time 1 letter/word reading	1.05	[0.97, 1.14]
Number of weeks in between testing	0.98	[0.70, 1.38]
CTOPP Phonological awareness	8.99*	[1.25, 64.85]
Dynamic assessment	1.03	[0.95, 1.10]

Note. CI = confidence interval.
* $p < .05$. ** $p < .01$. *** $p < .001$.

For the Pseudoword Decoding measure, adjusting for all other variables, only the *CTOPP* PA measure was significant in the model at the $p = .03$ level. The odds ratio meant that for every standard score increase in PA, it was almost 9 times more likely that the child would have Word Attack skills. Figure 2 shows the predicted probability of the child being a Decoder, conditional on a mean age of 63.31 months, time in between the two assessment sessions being 20 weeks, with the family SES, receptive language and expressive language scores, PA, and Time 1 letter/word reading all set at the means, varying as a function of the dynamic assessment score. There are three lines in the figure to display how home language background would affect the predicted probability.

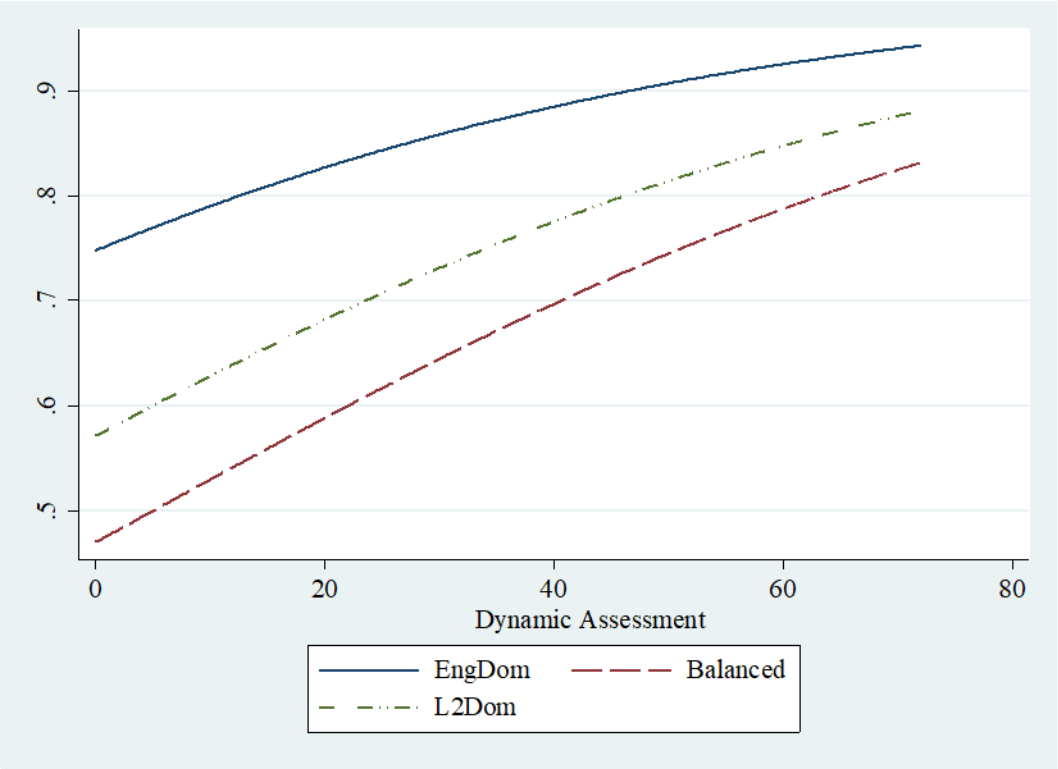

Figure 2. Probability of being a Decoder varying by home language background and dynamic assessment score.

Predicting phonological awareness at Time 2. For the final regression analysis, because I aimed to predict variance in later PA scores, I removed the home language dominance group, instead including phonological memory and RAN scores, as these are scales included in the *CTOPP* as well and have been found to be related to PA. This was done to restrict the number of variables in my regression model for the number of observations in my sample, and also because based on the results from Research Question 1, I had already established that home language background does impact upon PA scores.

Table 11
Regression Analysis Results for CTOPP PA Outcome Measure

	Model 1	Model 2
Step 1		
Age	-0.02 (0.01)	-0.01 (0.01)
Family SES	-0.02 (0.02)	-0.01 (0.02)
Receptive language	-0.001 (0.003)	-0.002 (0.003)
Expressive language	0.08 (0.07)	0.09 (0.07)
Time 1 letter/word reading	-0.004 (0.005)	-0.01 (0.005)
CTOPP Phonological Awareness	0.80 (0.07)***	0.68 (0.11)***
Phonological memory	0.06 (0.05)	0.08 (0.05)
Rapid automatized naming	-0.04 (0.06)	-0.04 (0.06)
Number of weeks in between testing	0.05 (0.02)**	0.05 (0.02)**
Step 2		

Dynamic Assessment		0.01 (0.004)*
Total R^2	.84	.84

Note. Standard errors are in parentheses.
* $p < .05$. ** $p < .01$. *** $p < .001$.

For the final outcome variable, the model explained 84.3% of the variance in the *CTOPP* PA outcome measure. In this model, the number of weeks in between the two testing sessions ($t = 3.15$, $p = .002$), earlier PA measure ($t = 6.37$, $p < .001$), and our dynamic assessment measure ($t = 2.01$, $p = .048$), were significant in predicting later PA. Thus, this was the only variable in which the dynamic assessment measure was found to add any significant variance explained in our outcome variable. This finding suggests that the dynamic assessment task was indeed measuring something slightly different from the PA measure. On the other hand, the additional variance explained is less than 1%, leading to question the practical utility of this task in predicting additional variance.

Research Question 3

Finally, in order to gain a better overview and perspective of the individual student profiles, I posed the following third research question: Are specific students prototypical in terms of literacy development and performance on the targeted assessments? In particular, how well does home language background predict the children's performance on the language and literacy assessments?

In order to effectively address this qualitative research question, I divided the assessments into three broad categories: the General Language measures (i.e., the *BLAB* and the *CELF*), the PA measures (i.e., the *CTOPP* and the dynamic assessment task), and the Reading measures (i.e., the *YARC* and the *WJ-III*). I plotted each child's scores relative to the sample on a graph, and identified children who were high on all three, low in all three, or had a pattern of both strengths and weaknesses across the three categories. I identified six different students and profiled their performance on the various assessments. These different profiles illustrate the patterns of performance displayed by the children in my study. Figures 3 through 8 show the profiles of the six children using the z-scores of all the various subtests for a clearer comparison relative to the current sample. Pseudonyms are used throughout to protect the identity of each child and maintain anonymity.

Above-average performance on almost all tasks. The first child I selected, George, was from a predominantly English-speaking family, and his scores are typical of a child with good language and reading skills. He performed well on all of the aspects measured, with the exception of the Mandarin *BLAB*, although his score would be considered above average when compared to other children from predominantly English-speaking families. Based on the standardized scores from the *CELF*, George obtained an average score for his age across the three subtests which assessed grammar, vocabulary, and sentence repetition. He received the maximum score on the dynamic assessment task, needing no prompts on any of the items. Similarly, he had above average scores on the *CTOPP*. Even at the first assessment, George could already recognize almost all the words on the *YARC*. Similarly, he could read many of the words on the *WJ-III*, and also the pseudowords given in the assessment. Based on his performance, George has strengths in his language and literacy skills.

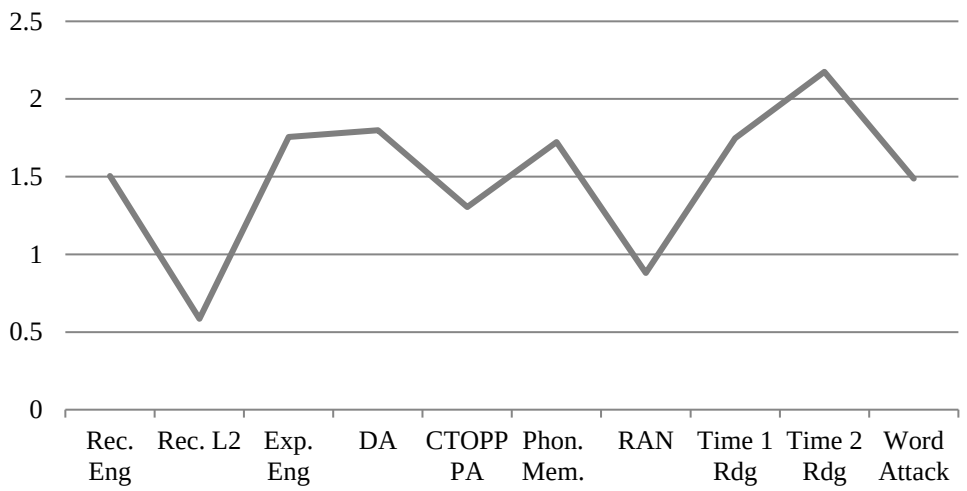

Figure 3. George's performance on the various assessments.

Two children from predominantly Mandarin-speaking homes. Turning to children whose profile was not as straightforward as George's, I highlight the profiles of two children who are from predominantly Mandarin-speaking homes. The first child, Lin, spoke predominantly Mandarin at home, and her parents filled in the Chinese version of the LBQ. She scored highly on both *BLAB* subtests, with higher Mandarin than English scores, and obtained a low average score on the *CELF* compared to other children of her age according to the standardized norms. A closer look at her performance on the *CELF* shows that she had poorer knowledge of grammar and vocabulary in English (whereas she knew quite a few of the words in Mandarin), and she had an average score on the Recalling Sentences subtest. In contrast to her expressive language in English, Lin displayed superior to very superior PA and RAN scores, and high average phonological memory. On the dynamic assessment task, Lin required few prompts, and when she did, it was a maximum of two prompts, in order to correctly segment the given word. She could read many words, and displayed good pseudoword decoding skills.

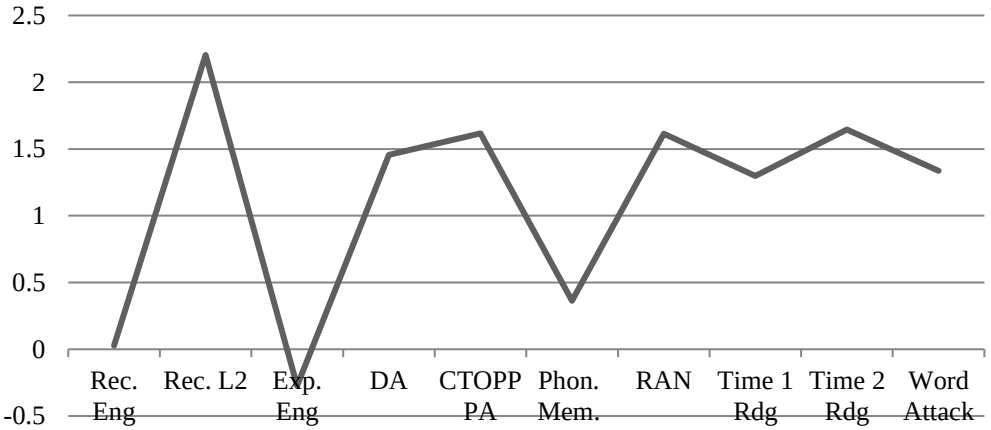

Figure 4. Lin's performance on the various assessments.

In contrast, the second child, Rui-En, whose family was also predominantly Mandarin-speaking and spoke some Chinese dialect as well, obtained a low score on the *CELF*, at the 5th percentile compared to her age norms. However, she too had high scores on the *BLAB*, displayed

above average PA, and had no trouble with the segmentation task on the dynamic assessment, thereby obtaining a perfect score. She also could read many words, and displayed good pseudoword decoding skills. Therefore, as her only weakness was on the *CELF*, her relatively low score on this measure could be attributed to her home language background, being predominantly Mandarin-speaking. Some of her errors on the *CELF* include pronominal confusion between “his” and “her,” “him” and “her,” and not adding morphological markers to denote plurals and tense such as saying “horse” instead of “horses,” and “fly” instead of “flies.” This pattern is likely because Mandarin does not have the same tense markers and does not differentiate between “him” and “her” in spoken language. Similarly, Rui-En’s expressive vocabulary in English was not as well-developed. She did not know the word “wrap,” but instead described the action as “making a box for present,” and she called the branch a “tree trunk.” These errors are typical of a second language learner.

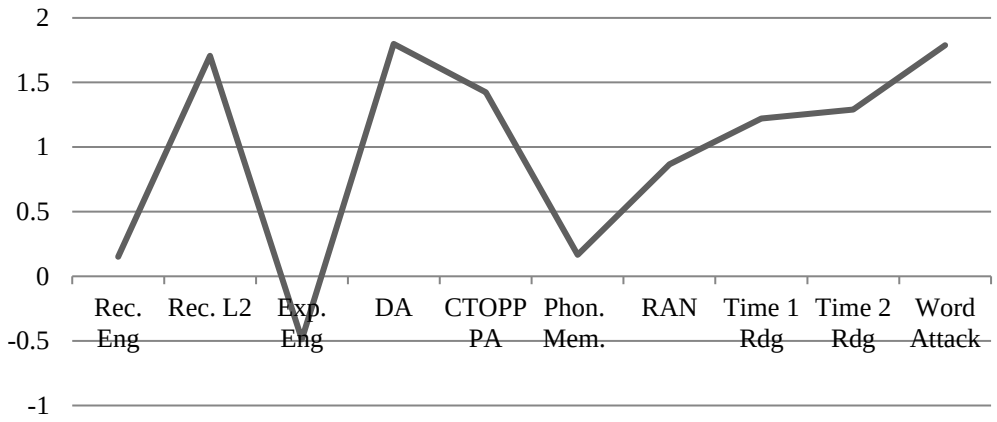

Figure 5. Rui-En’s performance on the various assessments.

Adequate phonological awareness but no pseudoword decoding skills. The next child I profiled was Kevin, a Balanced Bilingual based on the LBQ. Kevin scored average and low average on the *BLAB* and *CELF*, respectively, indicating that he has average language skills. He could not do the Elision task at all in the first assessment, and therefore obtained a below average PA score. On the dynamic assessment task, Kevin usually needed the maximum number of prompts in order to complete the task, suggesting that he was imitating the examiner to segment the words. In terms of behavior, he was noted to display poorer attention on the PA tasks, and often needed re-direction to the task at hand. However, Kevin could already read many words for his age, even at Time 1. During the follow-up assessment, he could read an adequate number of words, but displayed no pseudoword decoding skills at all, leading me to conclude that he is most likely reading words from memory. This strategy would most likely not be adequate, as he will be required to learn more words in the future. Interestingly, it was noted that Kevin’s performance on the LWI task fell slightly relative to his peers. Although it cannot be ascertained whether this difference was significant, it does suggest that his word reading might suffer if he is not given extra attention in terms of PA and explicit phonics instruction to teach him some decoding skills.

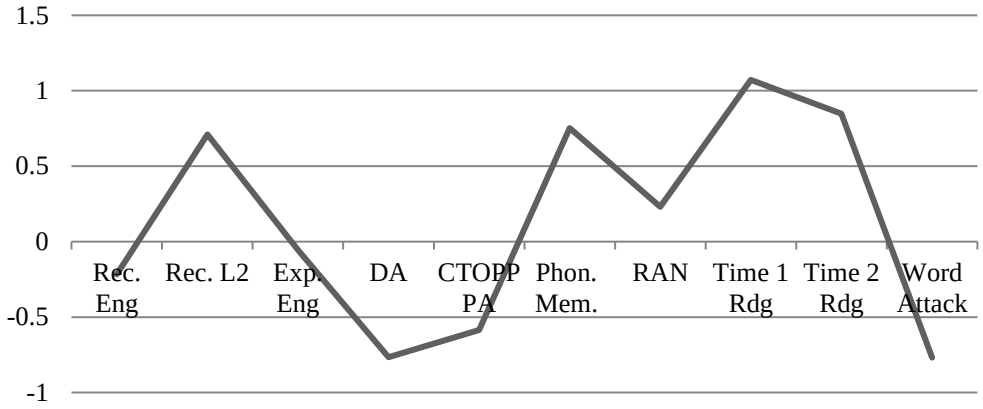

Figure 6. Kevin's performance on the various assessments.

Possible case of Primary Language Impairment. One child I had concerns about was Siti, a child who was predominantly Malay-speaking at home. She was very quiet, though compliant, and she scored very poorly on both the English and Malay *BLAB* tests, even compared to other children from mainly Malay-speaking households. Comparing her performance to that of other children of her age in the *CELF* normative sample, she obtained a very low score, at the 0.3 percentile. She did not know many words; for example, when asked to describe a boy who was riding a bicycle, in response to the question, "What is he doing?", she said, "play." She also had difficulty repeating the sentences verbatim on the Recalling Sentences subtest. She needed the maximum amount of scaffolding on the dynamic assessment task, but struggled when the number of sounds in the word increased to three. On the *CTOPP*, Siti could not do the Elision task, and also struggled with the Sound Matching task. On the other hand, she had average phonological memory and RAN scores. Siti could not recognize any words, although she could recognize her name from among some words I wrote out for her, and she had no pseudoword decoding skills. Siti's profile was one of concern, as it is possible that she has a language-based learning difficulty such as Primary Language Impairment, which can be defined as "low language performance in the face of otherwise typical development" (Kohnert et al., 2009, p. 101). While this diagnosis cannot be confirmed because this was a brief assessment used for the purpose of research, it was clear that Siti struggled on all the aspects that were assessed (i.e., language and literacy). Her teachers and parents were notified of my concern, and they were advised to consider referring her for further assessment.

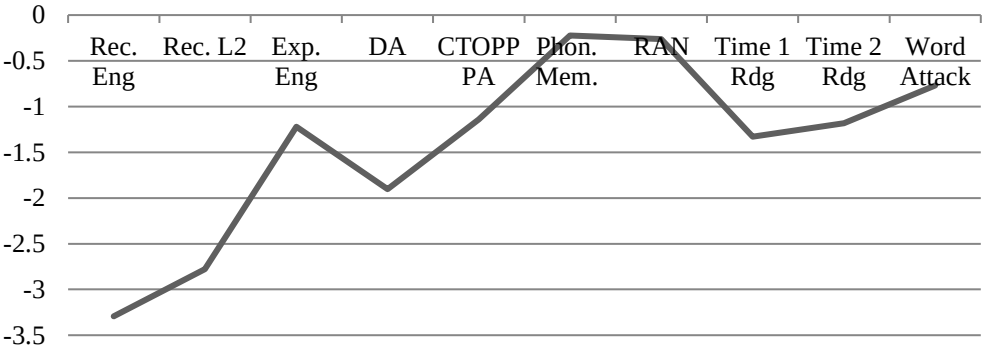

Figure 7. Siti's performance on the various assessments.

A child who benefitted from the DA scaffolding. Finally, Nicholas was from a predominantly English-speaking family who scored high on the *BLAB*, with slightly better English scores compared to Mandarin. He obtained a low average score on the *CELF*, and average scores on the *CTOPP* (See Figure 8). Given some time, he could segment the sounds independently on the dynamic assessment task, and benefitted from some scaffolding. He performed better on the dynamic assessment task than the *CTOPP* PA tasks relative to his peers. This pattern suggests that he would benefit from the types of prompts given in the dynamic assessment task, and points to how he might benefit from specific classroom instruction.

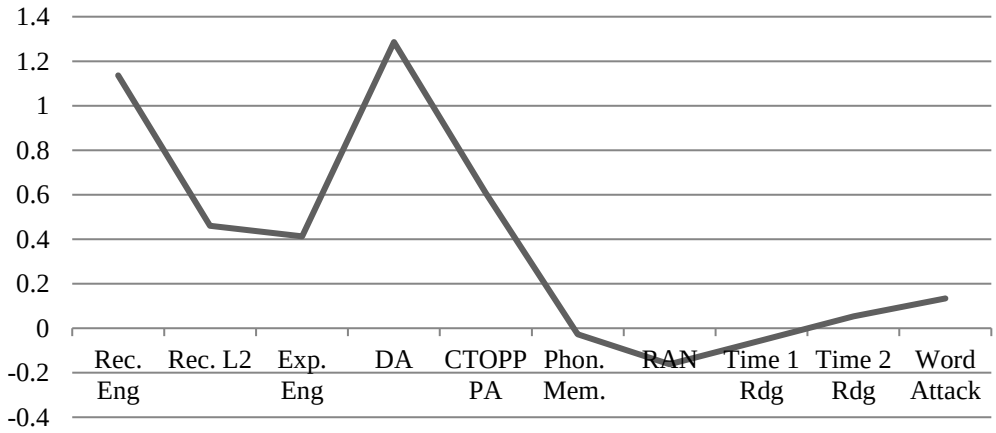

Figure 8. Nicholas' performance on the various assessments.

Overall analysis. These six different profiles of various students in my sample illustrate that each child's performance is unique, and although group analysis is useful for answering my first two research questions and identifying broad trends in student performance, ultimately for the purpose of catering the intervention to each individual child, there needs to be a closer look at individual performance. The six students chosen represent a variety of performance across the range, and they also demonstrate how two children from similar backgrounds may perform quite differently on the assessments. Ultimately, teachers do have to appreciate the needs of the individual child in order to cater to the specific strengths and weaknesses of each child in the classroom.

Therefore, the use of qualitative analysis in the current study is important, as it serves to provide more context and information about the students. In the next chapter, I discuss the implications of the study findings.

Chapter 5: Discussion

In this chapter, I focus on the interpretation of the findings, implications for research and practice, study limitations, and recommendations for future research in the field. As a broad summary of the study results, I found that both home language and the expressive and receptive language skills of children in Singapore explained variance in their PA scores. Upon examining the best predictors of LWI using multiple regression analyses, I found that the earlier measure of letter/word reading explained most of the variance in later letter/word reading. In Chapter 4, I also described the profiles of six children which were most representative of the sample.

In my discussion of the findings, several themes emerge. These include the importance of taking into account the child's home language background when conducting psychoeducational assessments with any young child in a bilingual or multilingual setting. In addition, in this chapter, I return to my initial question of the predictive utility of the dynamic assessment tool for PA, and the more generic question of which variable best predicts later word reading for young children.

The research questions that guide the discussion section are as follows:

1. Do typically developing preschool students in Singapore who have more exposure to English and better developed English language skills perform significantly better on standardized tests of phonological awareness in English, compared to students who have less exposure to English and poorer English language skills?
2. Adjusting for language measures, current letter and word knowledge, and the family's socioeconomic level, does a dynamic test of phonological awareness contribute additional variance above and beyond an earlier standardized measure of phonological awareness in predicting later phonological awareness, word reading outcomes, and pseudoword decoding?
3. Are specific students prototypical in terms of literacy development and performance on the targeted assessments? In particular, how well does home language background predict the children's performance on the language and literacy assessments?

English Language Skills Impact on Phonological Awareness in English

Addressing Research Question 1, the results demonstrated that there are indeed significant differences between home-language groups based on the LBQ developed from the questionnaires by Pua and colleagues (2013) and Bedore and colleagues (2012) in terms of phonological analysis, which hold while accounting for their scores on the standardized measures of expressive and receptive language in English.

Importance of Expressive/Receptive Language Skills

Home language background (i.e., whether the families of the children spoke mostly English, their L2, or spoke between 40 to 60% of both languages at home) influenced children's scores on standardized general language and PA measures. The difference was most pronounced on the *CELF* language measures, on which the L2-dominant children fared poorest, with the Balanced Bilingual group in the middle. Thus, children with greater English language exposure did the best on this assessment.

Yet even when adjusting for the child's home language background, scores on the receptive and especially the expressive language skills in English contributed significant

variance in the children's PA scores. This finding confirms the hypothesis that PA, when measured in a specific language, is dependent on competence in that specific language. The practical implication is clear: the child's general language competency needs to be taken into account when measuring PA skills in that particular language. Still, it is difficult to determine the language in which a bilingual student should be tested, just as it may not be possible for a formal test to capture what bilingual students know in their two languages (Garcia & Pearson, 1993).

Importance of Home Language Background

Viewed from another perspective, when scores on the objective measures of expressive and receptive language were covaried, the child's home language background remained significant in explaining the variance in his or her PA scores. This result also has implications for the debate regarding the PA abilities of bilingual children. Based on the regression analysis, the results demonstrate that, when adjusting for the child's expressive and receptive language scores in English, a child from the Balanced Bilingual group had an estimated mean of 0.37 standardized *CTOPP* PA scores higher than a child from the English-dominant group. To some extent, this finding suggests that the Balanced Bilingual group had an advantage in PA skills over the English-dominant group, after controlling for English language scores.

Further research focusing on the PA skills of children based on their exposure to different languages is warranted before definitive conclusions can be made regarding a "bilingual advantage" in terms of PA. Rather than supporting the linguistic dependence hypothesis that bilingual children have superior metalinguistic awareness in all aspects including PA, the data suggest that PA is indeed language-specific, and English language ability predicts PA performance in English tasks. Examples of PA tasks in English include segmenting a word into its individual phonemes, whereas in Chinese, it might be more appropriate to segment a word into its onset-rime parts instead of each individual sound. This contention is consistent with the views of Bialystok (2007) and Kuo and colleagues (2016), who proposed that the role of bilingualism alone may not be the best predictor of children's development of PA skills. As mentioned earlier in Chapter 2, the effect of bilingualism on PA is variable and complex instead of having a unitary and simple association.

The Predictive Utility of Dynamic Assessment

Turning to Research Question 2, I asked: Adjusting for language measures, current letter and word knowledge, and the family's socioeconomic level, does a dynamic test of phonological awareness contribute additional variance above and beyond an earlier standardized measure of phonological awareness in predicting later phonological awareness, word reading outcomes, and pseudoword decoding? The general finding was that this study did not satisfactorily demonstrate the predictive utility of dynamic assessment of phonemic segmentation in addition to the standardized PA measure, including covariates. I now proceed to address each of the three outcome measures in greater detail.

Predicting Later Letter/Word Identification

For the LWI outcome measure, the prior letter/word reading score explained such a large amount of the variance that none of the other measures was significant. However, the results from Spector's (1992) study were replicated if I excluded the prior letter identification/word reading measure. When comparing the present study with other studies that found significant results (e.g., Bridges & Catts, 2011; Gellert & Elbro, 2017; Spector, 1992), there are a few

differences. First, this sample was chosen without prior screening or selection, unlike Spector's (1992) study, which included a sample of non-readers. Nor were the results similar to the studies by Bridges and Catts (2011) and Gellert and Elbro (2017), which screened and identified a group of children who were found to be "at risk" for reading disability. In short, dynamic assessment may only be useful for a certain subgroup of children, such as those at-risk for reading and language delay (c.f. Kantor et al., 2011). For example, the dynamic assessment task could be administered only with the children who had yet to recognize more than two words on the *YARC* word reading assessment. This point leads to the conclusion about the differential predictive validity of the dynamic assessment task, and demonstrates that dynamic assessment is indeed complementary to more traditional standardized assessment procedures (Cho et al., 2017).

Next, I compared the dynamic assessment task with a standardized PA measure that was comprised of three different subtests. Because the *CTOPP* PA measure encompassed three different aspects of PA (i.e., elision, blending, and identification of first or last sound), it is understandable why it was a more robust measure of PA compared to the dynamic assessment task that included only one aspect of PA (i.e., segmentation). The *CTOPP* PA measure can be viewed as a more holistic estimate of a child's PA, and s/he had different tasks on which to be successful. This points also to the contrast between standardized and dynamic measures, especially because dynamic measures tend to take more time and are therefore considered labor-intensive (e.g., Caffrey et al., 2008).

Last, and perhaps most importantly, earlier studies by Spector (1992), Bridges and Catts (2011), and Petersen and colleagues (2016), which demonstrated the predictive utility of dynamic assessment, did not include a prior letter/word recognition measure. Previous studies including such a measure acknowledge "the powerful autoregressive effects of reading and spelling" (Caravolas et al., 2012, p. 684). In addition, the window between the two testing sessions in the present study was only 4 to 6 months, which may be why the first measure of letter/word knowledge accounted for the vast majority of the variance in word reading outcomes, as there was insufficient time for the struggling readers to improve more than the strong readers.

Predicting Pseudoword Decoding

For the second outcome measure of pseudoword decoding, which required the students to read pseudowords such as *tib* and *flam*, I utilized logistic regression to determine the variables which would predict the odds of having decoding skills. Only the *CTOPP* PA measure was significant in the model, and the odds ratio meant that for every standard score increase in PA, it was almost 9 times more likely that the child would have Word Attack skills. The results of this analysis demonstrate the importance of PA in pseudoword decoding, consistent with the literature on PA and decoding.

Predicting Later Phonological Awareness

For the final outcome measure, covarying the child's age, SES, receptive and expressive language scores, letter/word reading at Time 1, phonological memory, and rapid naming scores, the number of weeks in between the two testing sessions, the PA measure at Time 1, and my dynamic assessment measure were the variables found to be significant in explaining variance in PA scores at Time 2. Thus, PA at Time 2 was the only variable in which the dynamic assessment measure was found to add any significant variance explained in our outcome variable. This finding suggests that the DA task was indeed measuring an aspect of PA slightly different from the *CTOPP* PA measure. It was probably assessing a specific aspect of PA: segmentation, and

required the child to identify all the parts of the word (beginning, middle, and ending sounds) in order to obtain the maximum score. Yet the additional variance explained was less than 1%, leading to question the practical utility of this task in predicting additional variance.

Which Variable Best Predicts Later Reading?

Overall, later reading was best predicted by earlier reading ability, as evidenced not just in our current study, but also in many other studies (e.g., Caravolas et al., 2012; Lerner & Lonigan, 2016; Rayner et al., 2001). Once again, this finding suggests that the children who were already behind or ahead in terms of their letter/word recognition remained so across the 4- to 6-month period. This result is unsurprising given that no specific intervention was put in place to change the trajectory beyond the regular business-as-usual lessons and any other special lessons which were already being offered by the schools and teachers. At the same time, it clearly demonstrates the need to apply different techniques or strategies for those children for whom decoding does not come as easily. Even at such a young age, struggling readers would be likely to benefit from additional attention and more direct code-focused instruction. Otherwise, the "Matthew effect" (Cunningham & Stanovich, 1997) might well play out, where those children who already can read go on to improve significantly in reading, whereas struggling readers become discouraged by their lack of progress, and the cumulative effect of their lack of reading experience becomes even more stark as time elapses. This exposure to print would also have long-term consequences on the cognitive development, knowledge, and learning of the child.

Individual Profiles

The present study also afforded me the opportunity to take a closer look at individual student profiles, especially in comparison with the other children in the sample. Comparing these culturally and linguistically diverse students with other members of a similar background provided a better measure of their relative strengths and weaknesses, reflecting a practical recommendations made by researchers in this field (e.g., Hasson et al., 2013), Kohnert, 2010; Notari-Syverson et al., 2003).

To answer Research Question 3, I selected six different children whose profiles are considered to be the most exemplary among the children who were assessed, with the other children falling somewhere in between (see Table 12). These six examples illustrate some of the issues faced by the children in terms of their strengths and weaknesses in the aspects of general language, literacy, and PA measures.

Table 12
Summary of Six Children's Profiles in Comparison to Study Sample

Measure	George	Lin	Rui-En	Kevin	Siti	Nicholas
Home-language background	English-dominant	L2-dominant	L2-dominant	Balanced Bilingual	L2-dominant	English-dominant
Performance on Language measures	Above average on all measures, with relative weakness in Mandarin receptive language scores	Average receptive and expressive scores in English; above average receptive language scores in Mandarin	Average receptive in English and above average receptive scores in Mandarin; slightly below average expressive scores in English	Average receptive and expressive scores in English; slightly above average receptive language scores in Mandarin	Well below average receptive scores in English and Malay; below average expressive scores in English	Above average on all measures, especially for receptive scores in English
Performance on PA measures	Above average on *CTOPP* PA and DA tasks	Above average on *CTOPP* PA and DA tasks	Above average on *CTOPP* PA and DA tasks	Below average on *CTOPP* PA and DA tasks	Below average on *CTOPP* PA and DA tasks	Above average on *CTOPP* PA; well above average on the DA task
Performance on Letter/Word Reading Measures	Above average on Reading and Word Attack	Above average on Reading and Word Attack	Above average on Reading and Word Attack	Above average Reading, below average on Word Attack	Below average on Reading and Word Attack	Average Reading and Word Attack

To an extent, George's profile does not warrant considerable commentary because his aptitude is what one might expect from a typically developing child from a predominantly English-speaking family. He demonstrated clear strengths in both language and literacy — the aspects of focus in this study. However, I found a more interesting profile in Lin, who despite being from a predominantly Mandarin-speaking family, also performed in the average to above average range on all aspects of the administered assessments. In particular, she displayed above average PA, and above average word reading and pseudoword decoding skills. At the other end of the spectrum, I profiled Siti, who may have had a language learning disability such as Primary Language Impairment, as she struggled on all of the aspects measured, even when compared to the other peers in the sample. I also discussed the cases of Rui En, who displayed what might be typical of a child from a predominantly L2-speaking background, and Kevin, who had yet to acquire decoding skills. The language and literacy assessments administered provided an understanding of their individual strengths and weaknesses on the various assessments both relative to the normative sample, as well as in comparison to the study sample.

Taking a closer look at these individual students demonstrates what a teacher would be doing after conducting such assessments or receiving such assessment results in order to develop a teaching plan which would better cater to the individual learning needs of the students in the classroom. For example, Kevin in particular would benefit from explicit teaching in PA and phonics to give him more skills to tackle new and unfamiliar words, whereas Lin and Rui-En would benefit from more vocabulary teaching and general language enrichment in English. It was recommended that Siti be referred for further assessment by a speech-language pathologist or psychologist if parents and teachers were concerned about her language and literacy development. Thus, examining Research Question 3 provides a glimpse into the story behind the numbers, and has fleshed out slightly more detail and insight into this sample of children from this particular context.

Practical Implications for Instruction/Intervention

Based on the study findings, some implications for practice can be drawn. These include the importance of early detection of children who are falling behind in terms of their language skills, letter/word knowledge, and PA, as well as implications regarding the role of dynamic assessment in distinguishing between children who have yet to pick up so quickly.

Importance of Early Intervention

I contend that this study speaks to the importance of early intervention, as it appears that the gap in terms of letter and word recognition was apparent even at ages 4 to 5. The benefits of early intervention are clear for future reading development. In addition, in terms of the children's psychological and social-emotional well-being, those who struggle with reading may be ridiculed by their peers or chided by their teachers. Facing any kind of failure might have a negative impact on the child's self-esteem, motivation, and mindset, especially if the teachers do not have an encouraging approach or growth mindset (e.g., Dweck, 2017; Yeager & Dweck, 2012). Thus, increased attention could be given to those children who have yet to recognize all the letters of the alphabet and some simple sight words toward the end of K1, as this seemed to be a more reliable indicator of later reading ability compared to the other measures.

Fortunately, current research has identified key components of evidence-based interventions for language and literacy difficulties in terms of teaching methodology (e.g., Clarke, Snowling, Truelove, & Hulme, 2010; Rayner et al., 2001; Snowling & Hulme, 2011;

Vellutino et al., 2004). With specific reference to teaching methodology, Snowling and Hulme (2011) reviewed the ingredients of evidence-based interventions for language and literacy difficulties. They concluded that it is good practice to ensure that interventions are systematic, well-structured, and multi-sensory, and incorporate direct teaching, learning, and time for consolidation, with frequent revision to take account of the likely limited attention and learning difficulties of the child. For dyslexia, effective interventions should include training in letter sounds, phoneme awareness, and linking letters and phonemes through writing and reading from texts at the appropriate level to reinforce emergent skills (e.g., Rayner et al., 2001). In contrast, poor comprehenders require a different 'diet' attuned to their needs, and they can benefit from training in oral language skills, particularly vocabulary training (e.g., Clarke et al., 2010). Of course, it is important to bear in mind that many children will have problems with decoding and comprehension, in which case a mixed approach is needed.

Role of Dynamic Assessment

The dynamic assessment task should be used for what it is meant for — to inform intervention or teaching efforts. As has been emphasized earlier in this dissertation, dynamic assessment seems to be more indicative of future performance for children who are under-performing on regular standardized tests. The principles of dynamic assessment can be used as part of formative assessment to construct a lesson plan or develop key aims for the individual student. Specifically, classroom practice should be formative in that "evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction" (Black & Wiliam, 2009, p. 9). It can be argued that one of the main purposes of assessment is to design an intervention plan or develop a curriculum of instruction for the student. Ultimately, each student has a unique learning profile and while the majority of students can benefit from a certain way of teaching, some require a different way of teaching. The next step would therefore be to design an intervention study using the results from these assessments.

With regard to the specific roles of dynamic and standardized assessments, I conclude that while each type of assessment serves a different purpose, they are complementary in nature. Standardized assessments provide a quicker and useful way of determining where the student is relative to his or her peers, whereas dynamic assessment would provide additional information regarding the specific area in which the student could benefit from more instruction or intervention. Although the majority of students can be served by static assessment, and screening tools may well be suited to this purpose, there will be some students, especially those who perform poorly on such measures, who need a more comprehensive assessment, and a tool that is more sensitive to individual differences, with often a more fine-grained measure of performance. These are the cases for which dynamic assessment may paint a fuller picture.

I return to the idea of RTI. Although I chose not to focus on RTI, this conclusion once again reminds us that the purpose of dynamic assessment/RTI is to better understand the specific types of intervention each child would benefit from. This is where the teaching/intervention part of the dynamic assessment/RTI process comes into play, and this is the part which provides a closer look as to which small group of students might warrant attention. Rather than stopping at the binary response question of whether the child is struggling, dynamic assessment goes beyond this to ask what specific aspect the child is struggling with, and which types of supports are needed for that particular case. Once again circling back to our initial question of the purpose of assessment, dynamic assessment provides extra information that goes beyond the numbers and

highlights the story behind the numbers. Specifically, dynamic assessment would be able to isolate the area in which the child requires extra scaffolding in order to succeed rather than stopping at the fact that the child cannot do the task when presented in a standardized manner.

Other studies have proposed that dynamic assessment can be used to identify nonresponders earlier than the traditional RTI approach for students with dyslexia (e.g., Aravena, Tijms, Snellings, & van der Molen, 2016; Gustafson, Svensson, & Fälth, 2014). Thus, dynamic assessment indeed has differential predictive validity depending on the student (Cho et al., 2017), meaning that dynamic assessment may be more useful for predicting outcomes for those who are struggling in that specific aspect. Thus, dynamic assessment would be useful to indicate where exactly the student is struggling, and where to direct the appropriate intervention/teaching. As a specific example, Cho and colleagues (2017) concluded that dynamic assessment made a significant and unique contribution in predicting word recognition development above and beyond the prior word reading measure, particularly for students with poor PA skills.

Role of Assessment in the Classroom

As for the practical question of who should be the professional conducting the assessment, the answer depends on existing policies and practices in a particular context. If the preschool teacher is trained to deliver quality instruction, assessment should be part of the routine of teaching (e.g., Black & Wiliam, 2009; Shepard, 2005). Assessment can and should be used by teachers in the classroom so that they can document the growth of individual students over time and thereby assess the students' progress. To put it in practical terms, every teacher should bear in mind Ramaprasad's (as cited in Black & Wiliam, 2009) three key processes of learning and teaching: establishing where the learners are in their learning, where they are going, and what needs to be done to get them there. The activities and strategies employed in the classroom should all undertake to address these three key processes.

However, for those contexts in which teachers have yet to be fully equipped with the time and resources to conduct such assessments, another professional who comes in to the classroom to conduct a screener to identify children who require extra help might be warranted. In any case, such regular screening or assessment should be embedded in the policies and practices in the classroom, especially at this crucial age when early intervention can be the most effective, and before the child experiences failure.

Implications for Bilingual/Multilingual Children

The present findings have once again emphasized the heterogeneity of bilingual learners, even those within the same context. Although for data analysis purposes I categorized the children into three main groups (English-dominant, Balanced Bilingual, and L2-dominant) based on the LBQ, a closer look at the data from the LBQ, and even their performance on the standardized assessments of language, demonstrates the wide range of language proficiencies in my sample. As immigration trends are on the rise and teachers find a variety of children from different language backgrounds in the same classroom, coupled with varying degrees of language and literacy experience at home, it is increasingly important not to assume that all children will benefit from the same kind of instruction. Accommodating to the specific needs of each child in the classroom is not easy, but it would be a practical necessity on the part of the preschool teacher.

In the current study, I chose to conduct the assessments primarily in English, because this language is the main medium of instruction in Singapore schools. In order to ascertain if a bilingual child has a true language-learning disorder, it is recommended that the child be assessed in both languages if possible, although in general, it is difficult to determine the language in which a bilingual student should be tested, especially since the monolingual norms may not apply in either language (e.g., Garcia & Pearson, 1993; Klingner et al., 2006). Although PA assessments do exist in other languages, it would be difficult to make comparisons across such tasks since these are mostly researcher-developed and language-specific.

The Use of Standardized Tests with a Different Sample

Finally, this study shows that the same assessments developed in other countries can be used with children from different populations to a certain extent. As mentioned in the earlier chapters, psychologists in Singapore often utilize measures developed in different countries because of the difficulty obtaining national norms for such a small population, and thus there has been debate as to whether national norming exercises are worth the time and effort for use. It is worth noting here that for test development in a different context or language, there would need to be cultural adaptation, not simply translation work (e.g., Hambleton & Patsula, 1998; Helms, 1992). My study suggests that the *CTOPP* remains a useful predictor of pseudoword decoding, and would also be practically useful since the majority of children in Singapore learn to read in English to some extent, and English is the main language of instruction in school. As the world becomes increasingly diverse, and with global mobility and immigration on the rise, a similar issue is faced by professionals who work with children in other countries who hail from different backgrounds. Yet scores should be interpreted with caution due to the fact that the normative sample is from another country. Based on the descriptive statistics from the current study, I compared the performance of the current sample with the sample on which the tests were normed, and demonstrated that cultural and linguistic differences exist. Although the Singapore sample performed more poorly on PA, especially on the *CELF* language measures when compared to the normative sample from the United States, they outperformed the normative sample on single-word reading, *CTOPP* digit repetition, and RAN. Similar to those from other studies (e.g., Helms, 1992; Yang, 2016), this finding demonstrates that standardized test scores cannot be used indiscriminately when the tests have been developed in a different country, even among other predominantly English-speaking samples.

The variance among children's performance on the standardized tests has implications for the use of standardized tools with children from culturally and linguistically diverse backgrounds. As many researchers and practitioners have advocated, assessment of English language learners and children from different cultures and language backgrounds from which the test was initially validated requires additional consideration and measures, including testing in the second language, and not relying solely on standardized test results, especially in the diagnosis of language learning disabilities (e.g., Hasson et al., 2013; Notari-Syverson et al., 2003). Although the similarity of the culture and educational system in Singapore and other Western countries in which these assessments were developed suggests that test adaptation is sufficient instead of developing a new test altogether, further research and test development are needed to identify specific differences and items that need modification (e.g., Hambleton & Patsula, 1998). There is a continued need for researchers, practitioners, and interventionists to develop more culturally-relevant assessments in order to accurately assess students and properly cater to their needs.

Limitations of Study

The main limitation of this study was that the duration between the two assessments was rather short. Ideally, the follow-up measures would have been administered about 9 months to 1 year after the initial assessment. In addition, several of the children in the sample already could recognize words even at the initial time-point, which also contributed to the finding that the earlier letter/word reading measure accounted for such a large proportion of the variance explained in the LWI outcome measure.

In addition, as this was primarily a replication study utilizing Spector's (1992) dynamic assessment procedure, the same task was used, which some children still struggled with. Without any prior experience of PA tasks, there were five children who were not able to comprehend the task instructions, even with the maximum amount of prompts in place. Therefore, these five children were excluded from the multiple regression analyses which involved the dynamic assessment task (i.e., those in Research Question 2).

Future Directions

This study has illuminated several interesting and important avenues for further investigation. First, it would be ideal to design specific instruction or intervention strategies based on the children's performance on the initial assessment, and then compare their reading outcomes with those who have no specialized intervention plan. This type of intervention study, while labor-intensive, should reflect the authentic assessment procedures which are ideally carried out on the classroom, and would be a meaningful follow-on study.

In a similar vein, longitudinal studies are ideal in contributing to the discussion on the best predictors of reading. Ideally, a follow-up study can be designed in which a different group of children are assessed first at an earlier age (e.g., at 4 years old) and then followed up at Primary One or Two, when they are 7 or 8 years old. Once again, replication studies can help to better our understanding of certain findings, such as regarding the differential predictive validity of dynamic assessment (c.f. Makel & Plucker, 2014). Specifically related to the present topic of the dynamic assessment of PA, if Spector's (1992) dynamic assessment task was for some reason not the best choice (e.g., if it was still too difficult for some children despite the scaffolding provided), a more suitable dynamic assessment task could be chosen.

Finally, in line with research focused on bilingual and multilingual children, the present study has given further impetus for examining the theoretical construct of PA, and how this construct is closely related to the language in which the task is administered. Further research could therefore investigate bilingual children's performance on a range of PA tasks in both languages, and also include measures of their language dominance and proficiency. Returning to our discussion of how reading and language are closely related, such research can strengthen our understanding of a theoretical model of how reading develops, and also when reading difficulties exist.

Concluding Remarks

Drawing together the key implications and conclusions made, this study has highlighted the importance of early instruction and intervention, since prior reading accounted for the majority of the variance in later reading, even at the age of 5. Wherever possible, PA should be assessed in the child's first language. For children from bilingual backgrounds, tapping into their ability in this domain may be enhanced if a more dynamic and sensitive measure is employed.

The variation in performance on the administered tasks also brings to mind the need to teach specific phonological and phonics skills in preschools in Singapore, while concurrently emphasizing a language-rich environment. This study has also demonstrated the impact of home language background in a child's learning. Any assessment of a child should be undertaken with some understanding of their language dominance and proficiency, which influences the child's PA and reading development.

Finally, regarding the debate as to the predictive utility of dynamic assessment, this study has also demonstrated the importance of choosing suitable tests. Well-constructed, standardized measures can still be used to identify those who are at risk of being poor readers, and dynamic assessment can act as a supplement to standardized measures to provide further information for instruction and intervention. Ultimately, dynamic assessment provides differential predictive validity, and the conclusion is that it need only be used with a subset of children, rather than as a first-line screen.

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Appendix A

Language Background Questionnaire (English version)

We would appreciate it if you could fill in the blanks or tick the appropriate answer.
Thank you!

Your child's name _____ Today's date _____
Child's date of birth _____ Gender ☐ Male ☐ Female
If your child is not Singaporean, what is his/her nationality?_____
Number of years in formal schooling (including playgroup, nursery, and kindergarten) ___ years
Has your child lived in another country for some time? Yes / No
If yes, how long was that for? ____ years ____ months
Housing type: ☐ HDB 1-3 room ☐ HDB 4 room ☐ HDB 5 room/Executive flat/Maisonette
☐ Private housing ☐ Others (Pls. specify: _____)

Mother's language background
Highest level of education
☐ No formal education ☐ Primary ☐ Secondary/ITE ☐ A levels ☐ Polytechnic diploma
☐ University ☐ Other qualifications_____
If not Singaporean, what's your nationality?_____
How long have you lived in Singapore? ____ years
Are you currently working? ☐ Yes, working full time ☐ Yes, working part time ☐ No
If you are working, what is your occupation? _____

Father's language background
Highest level of education
☐ No formal education ☐ Primary ☐ Secondary/ITE ☐ A levels ☐ Polytechnic diploma
☐ University ☐ Other qualifications_____
If not Singaporean, what's your nationality?_____
How long have you lived in Singapore? ____ years
Are you currently working? ☐ Yes, working full time ☐ Yes, working part time ☐ No
If you are working, what is your occupation? _____

What languages do you use?
Please tick the language(s) that you and your husband/wife use with your child and write down how much of the time you and your husband/wife use this language (e.g., 90% English, 10% Teochew).

Language Mother uses with child		Language Father uses with child		Language Parents use with each other	
☐ English	%	☐ English	%	☐ English	%
☐ Mandarin	%	☐ Mandarin	%	☐ Mandarin	%
☐ Dialect (_____)	%	☐ Dialect (_____)	%	☐ Dialect (_____)	%
☐ Malay	%	☐ Malay	%	☐ Malay	%
☐ Tamil	%	☐ Tamil	%	☐ Tamil	%
☐ Others Pls specify _____	%	☐ Others Pls specify _____	%	☐ Others Pls specify _____	%

What languages do other caregivers use?

Do you have a maid? ☐ Yes ☐ No

Who looks after your child **most** of the time?

☐ Child's mother ☐ Child's father ☐ Maid ☐ Mother's parents ☐ Father's parents

☐ Another person (please tell us who this is) _____

Please tick the language(s) that the other caregivers use with your child and write down how much of the time they use this language (e.g., 90% English, 10% Teochew).

Language Mother's Parents use with child		Language Father's Parents use with child		Language Maid (or other caregiver) uses with child	
☐ English	%	☐ English	%	☐ English	%
☐ Mandarin	%	☐ Mandarin	%	☐ Mandarin	%
☐ Dialect (_____)	%	☐ Dialect (_____)	%	☐ Dialect (_____)	%
☐ Malay	%	☐ Malay	%	☐ Malay	%
☐ Tamil	%	☐ Tamil	%	☐ Tamil	%
☐ Others Pls specify _____	%	☐ Others Pls specify _____	%	☐ Others Pls specify _____	%

Your child's language proficiency

Please rank the languages that your child speaks according to how well he/she speaks that language. For rank 1, write the language he/she speaks best. For rank 2, write the next language he/she speaks best. Then, write down the earliest age at which he/she was exposed to this language (e.g., from birth, 2 years old).

Rank	Language	Earliest Age of Language Exposure
1		
2		
3		

We would like you to rate how well your child uses his or her languages. Rate the child's proficiency in English and his/her best language other than English using the following scales.

<u>Vocabulary Proficiency</u> refers to how often the child uses home vocabulary (e.g., food or clothing names) and academic vocabulary (e.g., science terms) in each language.

How much English vocabulary does your child use from the words she/he learns at home (e.g., food, clothing) or school (e.g., science terms)?

Does not speak in that language	A few words	A limited range of words	Some words	Many words	Extensive vocabulary	Don't know
0	1	2	3	4	5	DK

For your child's best language, other than English, how much vocabulary does your child use from the words she/he learns at home (e.g., food, clothing) or school (e.g., science terms)?

Does not speak in that language	A few words	A limited range of words	Some words	Many words	Extensive vocabulary	Don't know
0	1	2	3	4	5	DK

<u>Speech Proficiency</u> refers to how easily the child can be understood in each language.

How often can you understand your child's speech in English? Difficulties in this area might be noted when a child mispronounces a sound such a /r/ or /s/, a cluster of sounds (e.g., /sk/) or omits part of a word (e.g., says "evator" for "elevator" or "maposa" for "mariposa")

Does not speak in that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

How often can you understand your child's speech in his/her best language other than English? Difficulties in this area might be noted when a child mispronounces a sound such a /r/ or /s/, a cluster of sounds (e.g., /sk/) or omits part of a word (e.g., says "evator" for "elevator" or "maposa" for "mariposa")

Does not speak in that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

<u>Sentence Production Proficiency</u> refers to the usual length of the child's sentences when he or she is having a conversation, answering a question, or telling a story.

How long are your child's sentences in English typically? (Remember that children commonly use sentences of a certain length but regularly use sentences that are shorter when they are answering a question such as "Would you like a cookie?" or longer than the usual length)

Does not speak in that language	1-2 words	2-3 words	3-4 words	4-5 words	5 or more words	Don't know
0	1	2	3	4	5	DK

How long are your child's sentences in his/her best language other than English typically? (Remember that children commonly use sentences of a certain length but regularly use sentences that are shorter when they are answering a question such as "Would you like a cookie?" or longer than the usual length)

Does not speak in that language	1-2 words	2-3 words	3-4 words	4-5 words	5 or more words	Don't know
0	1	2	3	4	5	DK

Grammatical proficiency refers to the grammatical acceptability.

How often does your child produce well formed sentences in English when conversing or telling stories? Note: some forms that may be difficult in English are past tense forms (e.g., walked) or present tense forms (e.g., walks).

Does not speak in that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

How often does your child produce well formed sentences in his/her best language other than English when conversing or telling stories?

Does not speak in that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

Comprehension Proficiency refers to how easily the child understands each language.

How often does your child understand what is said in English? Note that difficulties in this area might be noted when she/he frequently asks for repetition or only attends to part of what you say (e.g., last part of a story, one part of a series of instructions).

Does not understand that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

How often does your child understand what is said in his/her best language other than English? Note that difficulties in this area might be noted when she/he frequently asks for repetition or only attends to part of what you say (e.g., last part of a story, one part of a series of instructions).

Does not understand that language	Never	Rarely	Sometimes	Very often	Always	Don't know
0	1	2	3	4	5	DK

Thank you very much for completing this questionnaire!

Appendix B

Prompts provided for the dynamic phonological awareness task based on Spector (1992)

Directions: “Let’s play a game with words and sounds. I will say a word and ask you to break the word apart. Tell me each sound that you hear in the word. For example, when I say ‘old,’ you say ‘o-l-d.’ Let’s try some.”

Prompt 1: “Listen while I say the word very slowly.” (Model) “Now can you tell me each sound?”

Prompt 2: “What’s the first sound you hear in _____?”

If first sound is correct: “Now can you tell me each of the sounds?”

If incorrect or no response: “Try to tell me just a little bit of the word.”

If child still does not isolate first sound, skip Prompts 3 and 4. Go to Prompt 5.

Prompt 3: If child correctly identified first sound but not next sound(s):

“__ is the first sound in _____. What sound comes next?”

“Now can you tell me each sound?”

Prompt 4: “There are 2 [or 3] sounds in _____. What are they?”

Prompt 5: “Watch me.” Model segmentation of word: Place a token in a square as each sound is spoken, then repeat word as a whole. After demo, say “Try to do what I just did.”

Prompt 6: “Let’s try together.” Model segmentation of word with child. Work hand-over-hand with the child and ask child to pronounce segments along with you.

“Now try to do it yourself. Do what we just did together.”

Prompt 7: Model again with child. “Now try to do it again yourself.”

Words to be included in this assessment: say, pie, we, two, age, eat, egg, if, leg, feet, page, rice

Appendix C

Psychometric Properties of the Major Study Variables

Variable	*n*	*M*	*SD*	Range		Skew
				Potential	Actual	
Time 1						
BLAB English	99	42.77	8.13	0-80	16-64	-0.13
BLAB L2	86	38.30	8.03	0-80	16-62	-0.08
CELF Word Structure	99	9.65	5.32	0-24	0-20	0.20
CELF Expressive Vocabulary	99	19.89	7.83	0-40	4-37	-0.00
CELF Recalling Sentences	99	18.04	7.11	0-37	2-34	0.08
Dynamic Assessment	94	40.43	17.55	0-72	3-72	-0.01
CTOPP Elision	99	7.06	5.91	0-34	0-19	0.14
CTOPP Blending Words	99	10.29	5.10	0-33	0-22	0.29
CTOPP Sound Matching	99	11.31	6.54	0-26	0-25	0.13
CTOPP Memory for Digits	99	14.77	2.56	0-28	10-20	-0.08
CTOPP Nonword Repetition	99	10.36	2.58	0-30	4-16	-0.26
CTOPP Rapid Naming – Colors	99	43.44	15.73	NA	19-105	1.28
CTOPP Rapid Naming – Objects	99	46.52	13.98	NA	22-95	0.67
Letter Sound Knowledge	99	26.25	3.90	0-32	10-32	-1.00
Early Word Recognition	99	10.46	10.38	0-30	0-30	0.74
Time 2						
CTOPP Elision	92	10.13	5.83	0-34	0-26	-0.09
CTOPP Blending Words	92	11.30	5.14	0-33	2-22	0.29
CTOPP Sound Matching	92	14.05	7.26	0-26	1-26	-0.12
Letter-Word Identification	92	25.39	11.31	0-76	10-58	0.93
Pseudoword Decoding	92	8.11	6.65	0-32	1-30	1.34