Identifying Kindergartners At-Risk for Learning Problems: Screening with the DIBELS and Components of the NEPSY-II

Rebecca Marcin
Pacific University

Recommended Citation

This Thesis is brought to you for free and open access by the College of Health Professions at CommonKnowledge. It has been accepted for inclusion in School of Graduate Psychology by an authorized administrator of CommonKnowledge. For more information, please contact CommonKnowledge@pacificu.edu.
Identifying Kindergartners At-Risk for Learning Problems: Screening with the DIBELS and Components of the NEPSY-II

Abstract

Early identification of children “at-risk” for learning problems is vital to future academic success; thus, it is critical that educators and psychologists implement the most efficient and thorough assessment strategies with young children. In Oregon, the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) is currently being administered to Kindergarten children as a universal assessment measure assessing for problems with reading ability, most specifically, phonological processing skills. Although the DIBELS has shown some merit in this capacity, it has rarely been compared to other standard measures that are frequently used to diagnose learning disorders. Additionally, little is known about the DIBELS’ ability to detect learning problems in children who have underlying deficits in other cognitive skills, such as executive functioning. In order address the gaps in the literature, this study investigated the DIBELS relation to other measures of phonological processing and executive functioning, namely, the Phonological Processing, Speeded Naming, and Inhibition subtests of the Developmental Neuropsychological Assessment-Second Edition (NEPSY-II), and compared risk identification rates between these measures in a classroom of Kindergarteners. Results indicated that although the DIBELS does seem to relate well to a measure of executive functioning, it also appears that the DIBELS subtests may not be capturing all forms of learning problems that could eventually lead to learning disabilities. Thus, it appears as though administration procedures for identifying children “at-risk” for learning problems should also include measures that assess for other cognitive skill deficits. The NEPSY-II subtest of Inhibition appears to contribute well to the early identification of risk because of its ability to assess for executive functioning skill deficits, and therefore, it is suggested that measures of executive functioning be administered alongside the DIBELS subtests in order to most effectively screen for learning problems.

Degree Type
Thesis

Degree Name
Master of Science in Clinical Psychology (MSCP)

Committee Chair
Susan Tinsley Li, Ph.D.

Keywords
DIBELS, NEPSY-II, learning disorder, assessment, academic risk, early childhood

Subject Categories
Psychiatry and Psychology

This thesis is available at CommonKnowledge: https://commons.pacificu.edu/spp/131
Copyright and terms of use

If you have downloaded this document directly from the web or from CommonKnowledge, see the “Rights” section on the previous page for the terms of use.

If you have received this document through an interlibrary loan/document delivery service, the following terms of use apply:

Copyright in this work is held by the author(s). You may download or print any portion of this document for personal use only, or for any use that is allowed by fair use (Title 17, §107 U.S.C.). Except for personal or fair use, you or your borrowing library may not reproduce, remix, republish, post, transmit, or distribute this document, or any portion thereof, without the permission of the copyright owner. [Note: If this document is licensed under a Creative Commons license (see “Rights” on the previous page) which allows broader usage rights, your use is governed by the terms of that license.]

Inquiries regarding further use of these materials should be addressed to: CommonKnowledge Rights, Pacific University Library, 2043 College Way, Forest Grove, OR 97116, (503) 352-7209. Email inquiries may be directed to: copyright@pacificu.edu
IDENTIFYING KINDERGARTNERS AT-RISK FOR LEARNING PROBLEMS: SCREENING WITH THE DIBELS AND COMPONENTS OF THE NEPSY-II

A THESIS SUBMITTED TO THE FACULTY OF SCHOOL OF PROFESSIONAL PSYCHOLOGY PACIFIC UNIVERSITY HILLSBORO, OREGON BY REBECCA MARCIN IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN CLINICAL PSYCHOLOGY JULY 23, 2010

APPROVED: ______________________________

Susan Tinsley Li, Ph.D.
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>vii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>viii</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>BACKGROUND INFORMATION ON LEARNING DISORDERS</td>
<td>3</td>
</tr>
<tr>
<td>Learning Disorder Definition and Diagnostic Criteria</td>
<td>3</td>
</tr>
<tr>
<td>Epidemiology of Learning Disorders</td>
<td>4</td>
</tr>
<tr>
<td>Learning Disorder Subtypes</td>
<td>5</td>
</tr>
<tr>
<td>- Reading Disorder</td>
<td>6</td>
</tr>
<tr>
<td>- Disorder of Written Expression</td>
<td>7</td>
</tr>
<tr>
<td>- Mathematics Disorder</td>
<td>8</td>
</tr>
<tr>
<td>- Learning Disorder NOS</td>
<td>9</td>
</tr>
<tr>
<td>- Academic Problem</td>
<td>9</td>
</tr>
<tr>
<td>Cognitive Processing Problems Underlying Learning Disorders</td>
<td>10</td>
</tr>
<tr>
<td>- Phonological Processing Deficits</td>
<td>10</td>
</tr>
<tr>
<td>- Executive Functioning Deficits</td>
<td>12</td>
</tr>
<tr>
<td>CURRENT ASSESSMENT OF LEARNING DISORDERS AND ACADEMIC RISK</td>
<td>14</td>
</tr>
<tr>
<td>Consultation Assessment</td>
<td>14</td>
</tr>
<tr>
<td>Universal Application Assessment</td>
<td>17</td>
</tr>
<tr>
<td>Early Identification of Risk</td>
<td>18</td>
</tr>
<tr>
<td>USE OF THE DIBELS IN EARLY SCREENING/ASSESSMENT OF ACADEMIC RISK</td>
<td>22</td>
</tr>
</tbody>
</table>
PROPOSED STUDY AND RESEARCH HYPOTHESES ............................................................25

METHOD ......................................................................................................................................27

Participants ......................................................................................................................................27

Procedure ........................................................................................................................................27

Measures ..........................................................................................................................................28

DIBELS ..............................................................................................................................................28

   Initial Sound Fluency Task ...........................................................................................................29

   Letter Naming Fluency Task .........................................................................................................29

   Phoneme Segmentation Fluency Task ..........................................................................................30

NEPSY-II ...........................................................................................................................................30

   Phonological Processing Subtest .................................................................................................31

   Speeded Naming Subtest ...............................................................................................................32

   Inhibition Subtest .........................................................................................................................33

RESULTS. ...........................................................................................................................................35

Hypothesis 1: Relationship between the Fall DIBELS and Other Measures of Phonological Processing .......................................................................................................................35

Hypothesis 2: Relationship between the Fall DIBELS and a Measure of Executive Functioning .................................................................................................................................37

Hypothesis 3: Relationship between Other Measures of Phonological Processing and the Winter DIBELS ......................................................................................................................37

Hypothesis 4: Relationship between a Measure of Executive Functioning and the Winter DIBELS ...........................................................................................................................................38

Additional Analyses: Relationship between the Fall and Winter DIBELS Administrations ...........................................................................................................................................39

Hypothesis 5: Comparison of Risk Identification between the DIBELS and Other Measures of Phonological Processing and Executive Functioning .........................................................................40
Additional Analyses: Rate of Agreement in Risk Identification between the DIBELS and NEPSY-II Subtests .................................................................44

DISCUSSION ..........................................................................................................................................................................................46

Summary .............................................................................................................................................................................................46

Limitations .......................................................................................................................................................................................53

Future Directions .............................................................................................................................................................................54

Conclusions ....................................................................................................................................................................................58

REFERENCES .....................................................................................................................................................................................59
Abstract

Early identification of children “at-risk” for learning problems is vital to future academic success; thus, it is critical that educators and psychologists implement the most efficient and thorough assessment strategies with young children. In Oregon, the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) is currently being administered to Kindergarten children as a universal assessment measure assessing for problems with reading ability, most specifically, phonological processing skills. Although the DIBELS has shown some merit in this capacity, it has rarely been compared to other standard measures that are frequently used to diagnose learning disorders. Additionally, little is known about the DIBELS’ ability to detect learning problems in children who have underlying deficits in other cognitive skills, such as executive functioning. In order address the gaps in the literature, this study investigated the DIBELS relation to other measures of phonological processing and executive functioning, namely, the Phonological Processing, Speeded Naming, and Inhibition subtests of the Developmental Neuropsychological Assessment-Second Edition (NEPSY-II), and compared risk identification rates between these measures in a classroom of Kindergarteners. Results indicated that although the DIBELS does seem to relate well to a measure of executive functioning, it also appears that the DIBELS subtests may not be capturing all forms of learning problems that could eventually lead to learning disabilities. Thus, it appears as though administration procedures for identifying children “at-risk” for learning problems should also include measures that assess for other cognitive skill deficits. The NEPSY-II subtest of Inhibition appears to contribute well to the early identification of risk because of its ability to assess for executive functioning skill deficits, and therefore, it is suggested that measures of executive functioning be administered alongside the DIBELS subtests in order to most effectively screen for learning problems.
Keywords: DIBELS, NEPSY-II, learning disorder, assessment, academic risk, early childhood
Acknowledgements

I would first and foremost like to thank Susan Li, Ph.D., my thesis and academic advisor, for her constant support and guidance over the course of this project and my graduate studies. I have truly appreciated your feedback and generosity throughout this process and am enormously grateful for the opportunities for assessment experience and research that you have made available to me.

My deepest thanks are to my family and friends for their love and encouragement. I am also infinitely grateful to my best friend and partner, Andrew, for his unwavering support throughout this endeavor. Without your help, understanding, and sense of humor, none of this would be possible.
List of Tables

Table 1: Means, Standard Deviations, and Bivariate Correlations Among DIBELS and NEPSY-II Subtest Scores ..............................................................36

Table 2: Means and Standard Deviations for DIBELS Subtest Scores at Fall and Winter Administrations .................................................................40

Table 3: Percentages of Children Identified as Having Risk Concerns on the DIBELS and NEPSY-II Subtests .................................................................41

Table 4: Fall and Winter DIBELS Risk Group Means, Standard Deviations, and Sample Sizes for NEPSY-II Subtests .........................................................42

Table 5: Fall Percentages of Children with Risk Concerns According to the DIBELS and NEPSY-II .................................................................45
Learning disorders are one of the most common disorders of childhood, affecting roughly 5% of school-aged children (American Psychiatric Association, 2000) and constituting the largest and fastest growing population of special needs children in schools (Semrud-Clikeman & Teeter Ellison, 2009). Many children who are referred for clinical evaluation because of behavior problems at school or problems completing homework have unrecognized language or learning difficulties (Pearl & Bryan, 1994), with some studies estimating that approximately one third of children referred to mental health centers have undiagnosed learning disorders (Cohen, Davine, Horodezky, Lipsett, & Isaacson, 1993). Children with learning difficulties often exhibit performance anxiety, poor peer relationships, family conflicts, decreased self esteem, and academic failure (American Academy of Child and Adolescent Psychiatry, 1998).

According to the Federal code and Individuals with Disabilities Education Act 2004 (IDEA), learning disorders may occur in conjunction with any of the major academic areas including mathematics, reading, written and oral language, and listening comprehension (U.S. Department of Education, 2004). Underlying the symptoms of a learning disorder are deficits in cognitive abilities. Deficits in cognitive abilities such as attention, executive functioning, verbal fluency and phonological processing have been implicated as key contributors to academic failure (Byrne, DeWolfe, & Bawden, 1998; Ferguson, Lyskey, & Hornwood, 1997; Lonigan, Anthony, Phillips, Purpura, Wilson, & McQueen, 2009; Velting & Whitehurst, 1997) and as underlying problems for children with learning disorders (Cohen, Vallance, Barwick, Im, Menna, Horodezky, & Isaacson, 2000). Academic failure is a strong predictor of negative developmental outcomes such as school drop-out, substance abuse, and deviant behavior (Berk, 2006).

Because learning disorders are more difficult to detect than many other childhood disorders, by the time the child is sufficiently delayed to meet criteria, they may be in second or
third grade and have developed significant negative perceptions of school and academic work. Early identification of potential deficiencies in cognitive abilities is essential in order to provide children with early intervention services to ensure academic success. In most environments, only children whose deficits are of sufficient severity to meet federal criteria are referred for further evaluation. Children with higher levels of intelligence, more subtle deficits, and from higher socioeconomic classes are less likely to be identified. Furthermore, due to a lack of public funding, children with mild difficulties often receive little or no academic assistance.

Currently, few if any models exist for how to screen children for learning problems in the early years before academic problems are substantial. Early screening measures for young children are state specific, and in the state of Oregon, the most common early screening measure is the Dynamic Indicators of Basic Early Literacy Skills (DIBELS; Oregon Department of Education, 2010). The DIBELS was developed in the 1980s by researchers at the University of Oregon (Kaminski & Good, 1996) and has shown some merit as an early screening measure (Burke, Hagan-Burke, Kwok, & Parker, 2009; Elliott, Lee, & Tollefson, 2001; Hintze, Ryan, & Stoner, 2003; Kamps et al., 2003). However, despite its widespread use, the DIBELS has a number of limitations. It has rarely been compared to standard measures that are frequently used to diagnose learning disorders in young children in professional settings. Furthermore, the DIBELS primarily assesses pre-reading skills rather than other cognitive skill areas.

In this paper, I first review various aspects of learning disorders and other factors associated with academic risk and discuss current measures used in the screening and assessment process of learning disorders in children, particularly cognitive measures and the DIBELS. In particular, I focus on the importance of early identification of young children “at-risk” for learning problems and discuss current practices used in this early identification of risk. I then
review the current study which attempts to determine which specific screening instruments can be used to identify young children who have deficits in cognitive skills that are thought to contribute to learning disorders and academic difficulties.

**Background Information on Learning Disorders**

Prior to considering ways to identify children “at-risk” for learning disorders, it is important to understand the nature of learning disorders including definitions, epidemiology, subtypes, and underlying deficits. I will thoroughly review this information in the following sections.

**Learning Disorder Definition and Diagnostic Criteria**

The terminology used to describe Learning Disorders is a controversial topic due to the important implications it can have on service provision within schools. The lack of normal development of a particular developmental skill is the central clinical feature of a Learning Disorder, where individuals can manifest significant difficulties in the acquisition and use of listening, speaking, reading, writing, reasoning, or mathematical abilities (Beitchman & Young, 1997).

According to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition—Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000), Learning Disorders are diagnosed when an individual’s achievement on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence and when the learning problems significantly interfere with academic performance or related activities of living. IDEA 2004, which specifies categories under which students with Learning Disorders can receive accommodations and assistance, emphasizes a similar definition; however, IDEA notes that
individual states are free to interpret the amount of discrepancy needed for eligibility and states
that an ability-achievement discrepancy (i.e., substantially below) is not required for eligibility of

Learning Disorders must be differentiated from normal variations in academic
achievement and from academic difficulties such as lack of opportunity, poor teaching, or
cultural factors, such as when English is not the primary language. Additionally, Learning
Disorders cannot primarily be due to sensory deficits such as impaired vision or hearing. When
these deficits are present, a Learning Disorder can only be diagnosed when the learning problems
are in excess of what is typically associated with the sensory deficit (American Psychiatric
Association, 2000). Typical onset for all Learning Disorders is early childhood; however,
problems are not frequently noticed until the child enters school (American Academy of Child

**Epidemiology of Learning Disorders**

Although the prevalence of Learning Disorders in the general population varies due to
different samples, diagnostic criteria, and assessment procedures (American Academy of child
and Adolescent Psychiatry, 1998), it is estimated that as a group, Learning Disorders comprise a
very common set of problems affecting approximately 10% of people and approximately 5% of
children in public schools within the United States who are currently receiving disability services
(American Psychiatric Association, 2000). Evidence suggests that these numbers are likely to be
higher, given that these figures refer only to individuals who have received school services and
that Learning Disorders are often under-diagnosed (American Academy of Child and Adolescent

Studies indicate that not only do approximately 50% of children with Learning Disorders
have a comorbid Axis I DSM-IV-TR psychiatric disorder, but also that the presence of a learning disorder raises the likelihood of also having a clinically significant comorbid Axis I disorder (American Academy of Child and Adolescent Psychiatry, 1998). Learning Disorders most frequently co-occur with Attention-Deficit Hyperactivity Disorder (ADHD), with studies estimating co-occurrence rates ranging from 10% to 50% (Riccio & Jemison, 1998). Several studies have suggested that children with ADHD share comparable problems with children with Learning Disorders, specifically problems with reading (e.g., Cantwell & Baker, 1991; Dykman & Ackerman, 1991; Swanson, Mink, & Bocian, 1999); however, the cognitive processes that underlie the differences are assumed to differ. For instance, children with ADHD are thought to perform poorly on general achievement, problem solving, language, and memory measures due to inattention, distractibility, and/or impulsivity, whereas children with Learning Disorders are assumed to perform poorly because of specific skill deficits (Swanson et al, 1999).

**Learning Disorder Subtypes**

The DSM-IV-TR specifies four types of learning disorders, including Reading Disorder, Disorder of Written Expression, Mathematics Disorder, and Learning Disorder Not Otherwise Specified (American Psychiatric Association, 2000). Reading Disorder and Disorder of Written Expression are classified as language-based disabilities, whereas Mathematics Disorder is a nonverbal type of disability, more strongly associated with problems in spatial cognition, visuoperceptual information processing, and social-emotional functioning (Beitchman & Young, 1997). The different subtypes of Learning Disorders often co-occur together (American Academy of Child and Adolescent Psychiatry, 1998), with Mathematics Disorder and Disorder of Written Expression most commonly occurring with Reading Disorder (American Psychiatric Association, 2000). When an individual meets criteria for more than one Learning Disorder, all
Reading Disorder. Reading Disorder, commonly referred to as “Dyslexia”, is the most prevalent Learning Disorder, accounting for an estimated four of every five cases of Learning Disorders and affecting approximately 4% of school-aged children. Children with Reading Disorder exhibit substantially poorer performances in reading achievement, accuracy, speed, and comprehension than would be expected based on the child’s age, measured intelligence, and education. In children with Reading Disorders, oral reading is typically characterized by distortions, substitutions, or omissions in words or word sounds, whereas both oral and silent reading are characterized by slowness and errors in comprehension (American Psychiatric Association, 2000).

Despite the fact that reading difficulties may emerge as early as Kindergarten, an official diagnosis of Reading Disorder is seldom made prior to the beginning of first grade when formal reading instruction typically occurs. When a child has above average to superior cognitive ability, a diagnosis of Reading Disorder is even less likely to occur earlier in schooling, as many children may function at or near grade level until they reach fourth or fifth grade when reading assignments become more difficult (American Psychiatric Association, 2000).

Reading Disorders are typically categorized into two different classes. Dyseidetic Reading Disorders may result from possible visual processing deficits, where the child may visually perceive letters of words in incorrect locations, may have difficulty perceiving whole words, or have problems analyzing visual shapes. This type of Reading Disorder is also often referred to as visual-perceptual, surface, or orthographic Dyslexia (Thompson, 1999). Dysphonetic Reading Disorders, on the other hand, reflect a speech discrimination deficit, where the child has difficulty processing phonemes, or the smallest segments of words. This kind of
Reading Disorder, also referred to as auditory Dyslexia, can interfere with a child’s ability to sound out words or to discriminate different sounds within words (Thompson, 1999).

**Disorder of Written Expression.** Children diagnosed with a Disorder of Written Expression, commonly referred to as “Dysgraphia”, typically demonstrate poor writing skills in the form of grammatical and punctuation errors, poor paragraph organization, errors in spelling, and poor handwriting. These children may also demonstrate problems in copying ability and in remembering letter sequences to common words. These difficulties significantly interfere with the child’s ability to compose written texts needed for academic achievement and activities of daily living. In order for a diagnosis of Disorder of Written Expression to be made, a child’s writing skills must be substantially below what is expected based on the child’s age, measured cognitive ability, and education (American Psychiatric Association, 2000).

Similar to Reading Disorder, Disorder of Written Expression is seldom diagnosed prior to second grade when more formal writing instruction takes place, despite the fact that difficulty in writing may appear much earlier. Furthermore, because assessment measures for writing are less well developed than tests for reading or mathematical ability, Disorders of Written Expression are typically more difficult to diagnose in the first place. The prevalence of Disorder of Written Expression is not well known, due to its high co-morbidity rate with other types of Learning Disorders (American Psychiatric Association, 2000).

Although not specifically identified within the *DSM-IV-TR*, deficits of Disorder of Written Expression are thought to fall within two broad categories (Osmon, Patrick, & Andresen, 2007). The first category includes problems in the basic writing skills of penmanship and spelling, and can result in phonological errors (e.g., deleting a sound in a word, such as writing pinsess for princess), orthographic errors (e.g., implausible spelling errors, such as sithed for
sight), and morphological errors (e.g., errors involving incorrect usage of prefixes and suffixes (Beringer & Amtmann, 2003). The second category, on the other hand, includes deficits in compositional skills, including the abilities to plan, revise, and edit writing (Graham & Harris, 2003). Although basic writing skills are needed in order to produce higher level compositions, composition skills require different cognitive abilities, and the two can be independently impaired (Osmon et al., 2007).

**Mathematics Disorder.** Mathematics Disorder, commonly referred to as “dyscalculia”, accounts for approximately one in every five cases of Learning Disorders, or approximately 1% of school-aged children (American Psychiatric Association, 2000). A sole diagnosis of Mathematics Disorder is highly unusual, as this disorder typically co-occurs with other types of Learning Disorders, most specifically Reading Disorder. A child diagnosed with Mathematics Disorder demonstrates mathematical ability that is substantially below what is expected based on the child’s age, measured cognitive ability, and education, and typically evidences significantly impaired academic achievement due to this disturbance in mathematics (American Psychiatric Association, 2000).

It appears as though a number of different deficits may underlie Mathematics Disorder including impairments in linguistic skills (e.g., the understanding or naming of mathematical terms, operations, and concepts), perceptual skills (e.g., the ability to recognize and read numerical symbols), attention skills (e.g., attending to operational signs and remembering to complete all the steps in a math problem), and mathematical skills (e.g., understanding the basic processes behind counting and different operations; American Psychiatric Association, 2000). Additionally, some have suggested that children with Mathematics Disorder display visuo-spatial deficits including problems with spatial representation, aligning columns, and understanding the
relationship between number and quantity (Semrud-Clikeman & Teeter Ellison, 2009).

Although problems in mathematical ability may be evident in younger children, a formal
diagnosis of Mathematics Disorder is usually not given until approximately the second or third
grade when more formal mathematics instruction has been given. In children with substantially
higher cognitive abilities, Mathematics Disorder may not be apparent until after elementary
school when coursework becomes more difficult (American Psychiatric Association, 2000).

Learning Disorder Not Otherwise Specified. Children who do not meet criteria for
any specific Learning Disorder, but still display significant problems in academic achievement
may be classified as having Learning Disorder Not Otherwise Specified. Children with this
diagnosis may exhibit problems in various skill areas that together significantly interfere with
functioning. This category may also include children who are struggling academically in
reading, writing, or mathematics, but who do not score substantially below what would be
expected based on their age, measured cognitive ability, and education (American Psychiatric
Association, 2000).

Academic Problem. Many children who demonstrate academic problems such as
failing grades and significant underachievement do not meet criteria for any specific Learning
Disorder or mental disorder. When a child of adequate intellectual capacity displays a clinically
significant academic problem in the absence of a Learning Disorder, the *DSM-IV-TR* V-code of
Academic Problem can be used instead (American Psychiatric Association, 2000). Children
falling into this category may be often categorized as “slow learners” instead of “learning
disabled”; however, just as with children diagnosed with Learning Disorders, children diagnosed
with Academic Problem require specific attention in order to remedy their academic difficulties.
Cognitive Processing Deficits Underlying Learning Disorders

Most assessment strategies for Learning Disorders are based on the idea that cognitive factors are involved in the manifestation of Learning Disorders, such that impairments in underlying core processing abilities are thought to be major contributors to Learning Disorders (American Academy of Child and Adolescent Psychiatry, 1998). The key cognitive deficits in Learning Disorders appear to lie in phonological processing skills (Gray & McCutchen, 2006; Lonigan et al., 2009; Mody, 2003; Stahl & Murray, 1994) and in executive functioning (Dally, 2006; Osmon et al., 2007; Strauss, Sherman, & Spreen, 2006). The next sections describe deficits in both of these cognitive processes.

Phonological processing deficits. Most recent conceptualizations of reading and writing difficulties have focused on linguistic factors, most importantly children’s phonological processing abilities as important underlying areas to evaluate (Lonigan et al., 2009).

Phonological processing refers to a wide range of phonological abilities that are developed across time and are differentially predictive of reading ability (Gray & McCutchen, 2006). Deficits in phonological processing ability are hypothesized to be the primary cause and the single best predictor of language-based Learning Disorders such as Disorder of Written Expression and more specifically, Reading Disorder (Semrud-Clikeman & Teeter Ellison, 2009).

Phonological processing can be broken down into three different phonological abilities including phonological awareness, phonological memory, and phonological access to lexical store (Lonigan et al., 2009). Phonological awareness is an awareness of the individual sounds that make up words (Dally, 2006) and requires the ability to use the phonemic segments of speech to detect, apprehend, or manipulate the sound structure of language (Stahl & Murray, 1994). Phonological awareness assists beginning readers to match familiar spoken words with
their written equivalents and is measured by tasks that assess rhyming abilities, sound-to-word matching, isolating single sounds from words, and blending and deleting phonemes (Dally, 2006; Semrud-Clikeman & Teeter Ellison, 2009; Stahl & Murray, 1994). Because phonological awareness affects a child’s ability to make judgments about and manipulate the phonological structure of words, poor readers often have difficulty tapping out the number of phonemes in a word, as well as adding, deleting, or reversing the order of phonemes in a word (Mody, 2003).

Phonological memory refers to the processes of storing and retrieving sound-based information (Lonigan et al., 2009). This aspect of phonological processing is typically measured by immediate recall of verbally presented material such as pseudoword repetition tasks (Mody, 2003). Children with deficits in phonological memory have difficulty maintaining accurate internal representations of the phonemes associated with the letters of a word, and may experience problems recalling letters, digits, words, or phrases in exact sequences (Goldstein & Schwebach, 2009; Lonigan et al., 2009).

Finally, phonological lexical access refers to the speed, accuracy, and efficiency with which children can retrieve phonological information from memory (Lonigan et al., 2009). Children who have difficulties in phonological lexical access typically have difficulties accessing their phonological representations of words, and when faced with a printed word, typically demonstrate articulation difficulties as they try and sound out the word (Mody, 2003). This aspect of phonological processing can be measured using rapid naming tasks where a child is required to name letters, digits, or numbers as fast as they can (Lonigan et al., 2009).

Research has shown that children who are poor readers do significantly worse than their normal reading peers on tasks of phonological processing (Lonigan et al., 2009; Mody, 2003; Stahl & Murray, 1994). Not only are phonological processing skills associated with severe
reading difficulties, but these skills are also predictive of growth in reading skills, where children who are better able at detecting or manipulating syllables, rhymes, and phonemes learn to read more quickly than do children who are less able to do these tasks (Lonigan et al., 2009). Children with reading difficulties can have a significant weakness in one or more of the phonological processing abilities. However, children who demonstrate weakness in more than one of the phonological abilities tend to have more serious reading impairments (Lonigan et al., 2009).

**Executive functioning deficits.** In addition to phonological processing deficits, children with Learning Disorders also demonstrate various executive functioning deficits. Executive functioning is a term used to describe a complex set of processes that act in a supervisory capacity of brain processing and encompass skills necessary for purposeful, goal-directed behavior (Baron, 2004). Volition, planning, purposive action, and effective performance are the four main components of executive functioning, each of which involves a distinctive set of activity-related behaviors (Lezak, Howieson, & Loring, 2004). Inhibitory control, or the ability to choose, construct, execute, and maintain optimal strategies for performing a task while simultaneously inhibiting strategies that become inappropriate when goals or task demands change, is often considered to be another key component of the executive functioning system (Lezak et al., 2004; Schachar & Logan, 1990). Together, these processes enable an individual to respond to novel situations in an adaptive manner and serve as a foundation for cognitive, emotional, and social skill development (Lezak, Howieson, & Loring, 2004).

In general, problems in executive functioning can result in inappropriate social behavior, decision making problems, difficulties devising, following, and shifting plans, problems with organization, distractibility, and memory problems (Baron, 2004; Lezak et al., 2004; Struass et
More specifically, problems in the executive functioning process can result in increased impulsivity (i.e., responding before a task is understood or answering before sufficient information is available), an inability to prevent attention from being captured by irrelevant stimuli, or failure to correct inappropriate responses (Schracher & Logan, 1994).

Depending on the academic area of difficulty, children with Learning Disorders may display different executive functioning deficits. For instance, some researchers suggest that an inability to attend to novel stimuli while inhibiting irrelevant stimuli may impede the acquisition and application of new material and may result in disorders of reading, writing, or mathematical ability (Dally, 2006). In children diagnosed with Disorder of Written Expression, executive functioning deficits in self regulation, planning and memory can impair a child’s ability to take the necessary steps to compose a written sample. For example, memory is crucial for writing because it allows children to access information about words, spelling, and rules for grammar, punctuation, and capitalization, and allows ideas to be utilized as the child is writing. Planning and self regulation are also important to the writing process, as a child must be able to simultaneously write while planning what is going to be written next and linking it to what has already been written (Osmon et al., 2007). Additionally, in children diagnosed with Mathematics Disorder, deficits in executive functioning interfere with problem solving, disrupt the organization of multiple step procedures, and impair the long term retrieval of mathematical related information (Osmon et al., 2007).

Although deficits in executive functioning can manifest in many different ways, it is undoubtedly true that these skills are needed for learning and that deficits within these skills can provide difficult challenges for children with Learning Disorders. Thus, assessment of both executive functioning skills and phonological processing skills in young children may help to
identify children “at-risk” for learning problems before such problems begin to significantly interfere with academic achievement.

**Current Assessment of Learning Disorders and Academic Risk**

Because most Learning Disorders only become apparent when a child reaches the 2nd grade or beyond, Learning Disorder assessment strategies are often not implemented until the child is elementary school aged. Procedures for identifying Learning Disorders and other areas of academic risk are typically categorized into two kinds of assessment strategies: consultation assessment and universal assessment (i.e., screening). The former generally takes place when a school-aged child who already evidences learning difficulties is referred to special education services or to a psychologist in order to determine if he or she meets criteria for a Learning Disorder. The latter are assessment procedures that are universally applied to all children in a given setting (e.g., a classroom) and serve as screening measures to identify children who may be “at-risk” of developing a Learning Disorder. Although consultation assessment procedures are typically more thorough and extensive than are universal application assessments, they also tend to be more time consuming and expensive in nature.

**Consultation Assessment**

Typical consultation assessments first require a thorough description of the child’s symptoms and areas of difficulty. This assessment generally includes a developmental and educational history, interviews with the child, parent, and teacher, behavioral observations, and most often, psychoeducational testing (American Academy of Child and Adolescent Psychiatry, 1998). Currently, in order for a child to be diagnosed with any type of Learning Disorder, the *DSM-IV-TR* requires that the child demonstrate an ability-achievement discrepancy in the area with which they are having difficulty (American Psychiatric Association, 2000). Thus, testing
should include the administration of individually administered tests of cognitive ability and academic achievement.

The most widely used tests of cognitive ability are the Wechsler tests, including the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III) for ages 2 through 7 and the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV) for ages 6 through 16 (Wechsler, 2002; 2003). The WPPSI-III and the WISC-IV assess a wide array of cognitive processes including verbal, visuo-spatial, processing speed, and working memory. Learning disabled children often demonstrate cognitive profiles that include variability among subtests and lower mean scale scores on certain groups of subtests, most specifically subtests assessing working memory and processing speed (Beitchman & Young, 1997). Measures of cognitive ability have been repeatedly shown to predict school achievement and provide a profile of strengths and weaknesses that are important to understanding the nature of a child’s learning style (Beitchman & Young, 1997; Bull, Espy, & Wiebe, 2009; Tramontana, Hooper, & Selzer, 1988; Wiese, Lamb, & Piersel, 1988).

The most widely used achievement measures for the diagnosis of a Learning Disorder are the Woodcock Johnson Test of Achievement-Third Edition (WJ-III; Woodcock & Johnson, 2001) and the Wechsler Individual Achievement Test-Third Edition (WIAT-III; Wechsler, 2010). Both of these measures assess various academic content areas including reading, mathematics, writing, and spelling. Achievement measures also provide useful information about a child’s academic strengths and weaknesses. When a child’s score in one of these academic areas is below what would be predicted based on performance on a cognitive ability measure, a Learning Disorder might be indicated.

The focus of an ability-achievement discrepancy model for diagnosing and defining
Learning Disorders has substantial implications for early identification of problems, especially because Learning Disorders can range in severity from subtle to marked impairment (American Academy of Child and Adolescent Psychiatry, 1998). As opposed to focusing on specific skill deficits, such as phonological awareness or executive functioning, this approach requires that a child fall behind academically before becoming eligible for diagnosis and treatment.

Due to some of the weaknesses in the ability-achievement discrepancy model for diagnosing Learning Disorders, several other assessment practices are currently being employed in addition to traditional cognitive and achievement measures. One of these alternative assessment practices includes thoroughly examining the component skills comprising different academic domains in order to gain useful information about a child’s strengths and weaknesses. For instance, in order to assess for reading difficulties, measures of phonological awareness and rapid naming can be utilized in order to provide information about a child’s ability to read words in isolation and in text, ability to sound out unfamiliar words, and knowledge of word sounds and corresponding letters (Beitchman & Young, 1997). A test like the Developmental Neuropsychological Assessment-Second Edition (NEPSY-II; Korkman, Kirk, & Kemp, 2007), which includes over 32 subtests assessing a wide variety of domains, may be helpful when there is a need to examine specific component processing skills. In particular, because this test does not yield domain scores, clinicians can tailor the administration of the test around the specific referral question. For example, if a Reading Disorder is suspected, the clinician can administer subtests comprising the Language Domain of the test. Other alternative assessment practices to the ability-achievement discrepancy model will be discussed in future sections.

In summary, a typical psychological consultation assessment battery for a school-aged child would likely include an evaluation of the child’s cognitive, academic, and specific skill
abilities. Ideally, the universal application of such a thorough assessment would increase the chances of identifying children whose problems would otherwise remain unnoticed.

Unfortunately, due to the complex nature of this kind of assessment, consultation assessments generally take more than 3 or 4 hours to complete and, thus, are not feasible for universal application. Universal application assessments are instead based on educational assessment strategies, often consisting of how well a child performs within a particular classroom system.

**Universal Application Assessment**

One of the newer universal application assessment methods for identifying learning problems includes the use of curriculum-based measurement (CBM; Ardoin, Roof, Klubnick, & Carfolite, 2008; ERIC Clearinghouse on Assessment and Evaluation, 1999; Shin & Lee, 2007; Wayman, Wallace, Wiley, Ticha, & Espin, 2007). According to this method, samples of a child’s performance across basic skill subjects representing local curriculum in reading, math, spelling, and written expression are collected on a continuous basis and are compared to other groups of students at the child’s grade level (ERIC Clearinghouse on Assessment and Evaluation, 1999). Eligibility and treatment decisions for Learning Disorders are then based on a child’s performance on these classroom-based measures as opposed to nationally normed measures which might not be as representative of the child’s problem (Semrud-Clikeman & Teeter Ellison, 2009). CBMs can be used for the purposes of screening and program placement and provide teachers with a fast and frequent method to measure progress in school subjects (ERIC Clearinghouse on Assessment and Evaluation, 1999; MClane, 2010).

Another, yet quite similar universal application method used for assessing learning difficulties in children is the Response to Intervention (RTI) model (Feifer, 2008; Flanagan, Ortiz, Alfonso, & Dynda, 2006; Fuchs, Mock, Morgan, & Young, 2003). This model integrates
assessment and intervention within a multi-level prevention system to maximize student achievement and to reduce behavior problems (Fuchs et al., 2003). The purpose of RTI is to instill a scientific process in educational systems when making decisions regarding student achievement, whereby schools identify students “at-risk” for poor learning outcomes, monitor student progress, provide evidence-based interventions and adjust the intensity and nature of those interventions depending on a student’s responsiveness, and identify students with learning disabilities or other disabilities (Feifer, 2008). According to this model, children receive interventions earlier on when a problem is first discovered, as opposed to having to wait until their academic problems are more serious in nature (Fuchs et al., 2003). RTI may eventually lead to consultation assessment or can also include initial screening measures.

**Early Identification of Risk**

Despite the fact that many models exist for assessing children for Learning Disorders in elementary school and beyond, few if any exist for detecting learning problems in younger children, before the problem is significant enough to impair functioning. Prompt identification of children likely to develop learning problems is crucial, as evidence indicates that early interventions can enhance learning prospects (Hindson, Byrne, Fielding-Barnsley, Newman, Hine, & Shankweiler, 2005). Although many agree that early identification and intervention are important, there has been a general lack of consensus surrounding what tools are most useful in identifying children “at-risk”.

Currently, there are three major approaches that are used to identify children “at-risk” for academic and learning problems: measures of readiness, measures of developmental risk, and measures of cognitive processing (Schraeder, 1993). Measures of readiness assess a child’s level of preparedness for a particular academic program, namely Kindergarten, and display some merit.
in predicting later academic achievement (Kurdek & Sinclair, 2001; Schraeder, 1993). The most widely used readiness measures assess verbal skills, visuomotor skills, adaptive behavior, and personal/social skills (Kurdek & Sinclair, 2001). Some examples of Kindergarten readiness measures include the Brigance K & 1 Screen, the Developmental Indicators for the Assessment of Learning-Revised, the Revised Gesell Preschool Examination, and the Phelps Kindergarten Readiness Scale, Second Edition (Duncan & Rafter, 2005; Kurdek & Sinclair, 2001).

Unfortunately, because these measures are designed to be administered before a child enters Kindergarten, universal and consistent application does not often occur. Furthermore, due to the nature of skills being assessed, poor scores may often reflect lack of experience or immaturity rather than an underlying problem (Schrader, 1993).

Measures of developmental risk and measures of cognitive processing are also assessments designed to identify “at-risk” children. Measures of developmental risk provide assessments of a wide range of areas and are designed to detect impairments that may limit a child’s ability to learn (Schraeder, 1993). Assessments like the Brigance Screens, the Batelle Developmental Inventory (BDI-2), and even the WPPSI-III are good examples of measures of developmental risk, as they all provide information about the functional abilities of young children (Hamilton, 2006; Newborg, 2005; Schraeder, 1993). Measures of cognitive processing, on the other hand, assess a child’s ability in discrete processes that are the basis for learning (Schraeder, 1993). For example, the NEPSY-II is an example of a cognitive processing test for young children, yielding information about specific component-skill deficits.

Although each of these measures has its own set of strengths, researchers have unfortunately not agreed upon which method is most useful in the identification of risk. Furthermore, despite the fact that each of these measures may be useful in the context of
additional information, independently they do not provide enough information about a child to make any significant conclusions regarding risk for learning problems. In order to make the most informed decisions regarding risk, these measures would ultimately need to be administered in combination with each other, something that may make universal application difficult due to the cost and time it would take to administer multiple assessments to all children within a given setting. Because of the various inefficiencies in the traditional models of early risk identification, it has been suggested that educators and psychologists attempt to downward extend universal application assessment strategies such as the ones discussed earlier so that they can be applied with much younger children (Elliott, Huai, & Roach, 2007). By utilizing these risk assessment strategies with younger than school aged children, it is likely that more children with learning problems will be identified earlier in their school careers, before such problems begin interfering with self esteem and academic achievement.

One new system being utilized to specifically identify young children between the ages of 3 and 5 who may be “at-risk” for learning disabilities is the Recognition and Response system (Council for Exceptional Children, 2010; Coleman, Buysse, & Neitzel, 2006). This system is a downward extension of the RTI model of identifying learning disabilities, where children who do not respond to intensive interventions in the general education setting are referred for special education. When it is suspected that a child may not be learning in an expected manner, teachers and parents can take steps to enhance their early school success (Coleman et al., 2006; Horowitz, Kaloi, & Petroff, 2007).

The Recognition and Response system is composed of three tiers of instruction (National Center for Learning Disabilities, 2010). In the first tier, teachers provide all students with a research-based curriculum and effective teaching strategies. In addition to providing these
specific educational practices, teachers also screen, assess, and monitor the progress of children within key academic areas. The incorporation of this assessment practice allows teachers to identify any child who may need additional supports. If a child is identified as having difficulty, the teacher advances to the second tier, where they provide interventions and curriculum modifications that require minimum adjustment to classroom routines. If a child still is struggling, the teacher advances to the third tier, where they implement more intensive and individualized instruction for those children who are not making adequate progress. Any child who does not make adequate progress while in the third tier may then be referred for more formal evaluation (Council for Exceptional Children, 2010; National Center for Learning Disabilities, 2010).

According to the Recognition and Response system, children who may be “at-risk” for learning problems are identified early, receive more targeted interventions, and have more opportunity to grow and develop in all academic domains. This system promotes a collaborative approach to response intervention and utilizes data to make educated decisions about strategies and to evaluate program effectiveness (Coleman et al., 2006).

Another universal application assessment strategy that can be applied when attempting to identify young children “at-risk” for learning problems is curriculum-based measurement (CBM). According to this model, children are identified as “at-risk” for a learning problem when their performance in a basic skill area is discrepant from the expectations of typical mainstream students (ERIC Clearinghouse on Assessment and Evaluation, 1999). Because typical expectations for basic academic skills are generally low for young children of Kindergarten age, modifications need to be made when extending the use of CBMs for such young populations. Instead of measuring basic academic skills, CBM is used with young
children to assess for the foundational and component skills that are needed for the successful development of basic academic skills. By applying this type of assessment as a universal screening for all children in a given grade level, educational staff have an increased chance of preventing or minimizing the magnitude of learning problems in children who are “at-risk”. One commonly implemented downward extension of a CBM is the DIBELS, as it assesses basic early literacy skills that are needed for successful reading instruction in young children (Good & Kaminski, 1996).

Use of the DIBELS in Early Screening/Assessment of Academic Risk

Because reading difficulties are the most pervasive academic problems that lead to placement in special education, “at-risk” readers must be identified as early and accurately as possible (Nelson, 2008). In Oregon, the most widely used screening measure for assessing children who may be “at-risk” for reading difficulties is the DIBELS (Good, Simmons, & Smith, 1998; Oregon Reading First Center, 2010). The DIBELS includes 10 brief measures designed for progress monitoring and early identification of children with reading problems. Subtests assess the core components of reading such as phonological awareness, the alphabetic principle, accuracy and fluency with connected text, vocabulary, and comprehension (Kaminski & Good, 1996), all of which have been found to be linked to one another and have been found to be predictive of later reading proficiency (Kamps et al., 2003).

The DIBELS subtests were developed based on a CBM model that would allow teachers to compare a child’s performance within the same set of skills, multiple times throughout the year (Kaminski & Good, 1996). Although the DIBELS measures are more generic in nature and draw content from sources other than any school’s specific curriculum, teachers are still able to continuously evaluate whether or not a child is learning and making progress toward designated
long-term goals. Thus, the DIBELS provides economical and efficient indicators of a student’s progress toward normative expectations in early literacy skills (Kaminski & Good, 1996).

Each DIBELS subtest provides benchmark goals that give teachers standards for gauging where a student is in the process of learning that particular skill (Good et al., 1998; Kaminski & Good, 1996). These goals represent the minimum levels of performance for all students to reach in order to be considered on track for the tested ability and were derived by establishing a minimum cut point at which 80-85% of students with that score had to achieve the next goal. The DIBELS also provides cutoff scores where the odds against achieving subsequent literacy goals are indicated. These cutoff points represent scores at which 20% or fewer students typically achieve the next goal. Teachers can utilize this information and identify which children are “at-risk” of not achieving their literacy goals unless additional support is provided (Kaminski & Good, 1996).

Despite the fact that the DIBELS has been well validated with other standardized measures of pre-reading skills such as the Test of Phonological Awareness (Elliott et al., 2001), the Comprehensive Test of Phonological Processing (Hintze et al., 2003), and the Word Identification and Word Attack subtests of the Woodcock Johnson (Speece, Mills, Ritchey, & Hillman, 2003) the DIBELS has not yet been validated with other standard measures of academic risk. Furthermore, because the DIBELS focuses primarily on pre-reading abilities, not much is known about how this measure relates to measures assessing other cognitive abilities. Finally, because the DIBELS use is so widespread, much more information about its effectiveness as an early screening tool is needed.

In summary, because of the devastating impact learning problems can have on a child’s academic achievement and self esteem, it is crucial that children “at-risk” for learning problems
are identified as early as possible. Assessment strategies for identifying young children “at-risk” for learning problems vary greatly, and unfortunately, researchers, psychologists, and educators have not come to a consensus regarding what method is best. There appears to be a strong disconnect between the types of assessments used in consultation assessment for referred children and more universal measures generated in an educational context. Whereas consultation assessments can provide a much more thorough picture of a child’s abilities, this kind of assessment is too time consuming to be used universally applied, and thus, is typically only used with children who are already displaying learning difficulties. Universally applied assessments appear to be the more feasible option for identifying “at-risk” children, as they can be utilized with entire classrooms of children; however, the ability of these assessments to provide thorough enough information to help in identifying “at-risk” children remains questionable.

It seems that in order to accurately and successfully identify young children “at-risk” for learning problems, assessment strategies should include the best combination of the most effective and thorough assessment measures, administered in an efficient and universal manner. In order to determine how to most efficiently and effectively screen young children for learning problems, researchers need to further examine assessment strategies that are currently being implemented. Thus, if the DIBELS is going to continue to be used to identify early risk, it is crucial that more information about its ability to detect other cognitive skill deficits be studied. For instance, although the DIBELS has shown promising results as a curriculum-based, universally applied assessment measure for children “at-risk” of reading difficulties, it is important that its utility in risk identification of other cognitive skills be examined. Moreover, it is also important to compare the DIBELS’s ability in identifying “at-risk” children with other measures that are frequently used to diagnose learning disorders in young children.
Proposed Study and Research Hypotheses

The proposed study attempts to address these holes in the literature by examining the DIBELS use in identifying young children who have deficits in cognitive skills that are thought to contribute to a variety of learning disorders. Specifically, this study will attempt to validate the DIBELS in reference to other objective measures of phonological processing and executive functioning. We were also interested in comparing risk identification with the DIBELS to these other measures in order to determine the best combination of assessments for identifying young children “at-risk” for learning problems.

Specific research hypotheses included the following:

1. It is hypothesized that scores from the fall administration of the DIBELS will be positively correlated to other objective, standardized measures of phonological processing, such as the Phonological Processing and Speeded Naming subtests of the NEPSY-II.

2. It is hypothesized that scores from the fall administration of the DIBELS will also be positively correlated to an objective, standardized measure of executive functioning, such as the Inhibition subtest of the NEPSY-II.

3. It is hypothesized that scores from other objective, standardized measures of phonological processing, such as the Phonological Processing and Speeded Naming subtests of the NEPSY-II will be positively correlated, and essentially predictive of scores on the winter administration of the DIBELS.

4. It is hypothesized that scores from an objective, standardized measure of executive functioning, such as the Inhibition subtest of the NEPSY-II will be positively correlated, and essentially predictive of scores on the winter administration of the DIBELS.
5. It is hypothesized that children identified as “at-risk” on the DIBELS will demonstrate greater problems on other measures designed to assess for learning difficulties, such as the Phonological Processing, Speeded Naming, and Inhibition subtests of the NEPSY-II, as compared to children not “at-risk” on the DIBELS.
Method

Participants

Participants included 17 Kindergarten students enrolled in a small, private Catholic school located in a suburb of a major metropolitan city in the Pacific Northwest. All students were recruited from one Kindergarten classroom, with the 17 participants representing 77% of the classroom sample. Nine students were male and 8 students were female. Participants ranged in age from 5 years and 2 months to 6 years and 3 months and had an average age of 5 years and 7 months (SD=0.35). Ethnicity of the participants was not directly evaluated. None of the children had previously been identified as “at-risk” for or diagnosed with a Learning Disorder and all children spoke English as a first language.

Procedure

Parent permission was given for all kindergarten children in the classroom to participate in the assessment sessions. Data collectors were two graduate students enrolled in a doctoral program in clinical psychology, supervised by one clinical psychology professor. Data collectors had taken coursework in child assessment and underwent a brief training period to become more familiar with the administration and scoring of the assessments. Following training, all measures were administered within a 2 week period in Fall 2009. Prior to the testing sessions, the Kindergarten teacher introduced the data collectors to the class. The data collectors then explained to the children that the purpose of the testing was to find out better ways to help children learn and do well in school.

Each child was tested individually outside of his or her classroom either in an office adjoining the classroom or in the school’s learning specialist’s office. Testing took place during the regular school day and lasted approximately 30 to 40 minutes per child. Several subtests from the NEPSY-II (Korkman et al., 2007) were given to the children. These tests addressed a
range of skills including phonological processing, speeded naming, and inhibition skills. After the testing, the child was invited to pick a gift from a prize bag of small trinkets and stickers.

Once all of the data was collected, the examiners prepared data sheets with relevant information about each child’s performance across the different measures and reviewed the information with the children’s teacher. Additional feedback forms were supplied to each child’s parent, acknowledging each child’s various strengths and weaknesses. No specific information was given to the children. Although the entire class was evaluated for the school’s purposes, only those who consented to allowing their information to be used for research purposes were included in the final dataset.

Examiners obtained each participant’s data record subsequent to the testing in Winter 2010. The data record contained information from the child’s regular DIBELS literacy screen for both the Fall and Winter assessments, which were administered to students according to the DIBELS three assessment periods schedule for the Kindergarten grade level. Administrations of the DIBELS were conducted by either the children’s Kindergarten teacher or the Kindergarten teacher’s aide, with the Fall administration of the DIBELS occurring within a few weeks of the NEPSY-II testing. Both evaluators were trained extensively in how to administer the DIBELS by the school’s Learning Specialist.

**Measures**

**Dynamic Indicators for Basic Early Literacy Skills (DIBELS).** The subtests comprising the DIBELS include Initial Sound Fluency (ISF), Letter Naming Fluency (LNF), Phoneme Segmentation Fluency (PSF), and Nonsense Word Fluency (NWF). Prior published studies on the DIBELS (Burke et al., 2009; Elliott et al., 2001; Kaminski & Good, 1996; Kamps et al., 2003) have indicated acceptable levels of reliability, including test-retest, alternate forms,
and interater for the DIBELS as a whole and for individual subtests of the DIBELS. Other studies have also provided support for concurrent validity of the DIBELS in relation to other measures of phonological processing, reading readiness, and teacher ratings of reading ability (Hintze et al., 2003; Kaminski & Good, 1996).

Using benchmark goals, test developers designated three levels of risk status (“at-risk”, “at some risk”, and “low risk”) for the two administrations of the subtests. All of the subtests from the Fall and Winter administrations except for NWF were used in the present study.

**Initial Sound Fluency (ISF) task.** The ISF task is a measure of phonological awareness designed to assess a child’s ability to recognize and produce the initial sound in an orally presented word. The child must be able to hear and manipulate the sounds in spoken words and understand that spoken words and syllables are made up of sequences of speech sounds. In this task, the examiner calculates the amount of time taken to identify and produce the correct sound and converts the score into the number of initial sounds correct in a minute. On the Fall administration of this subtest, a child earning scores between 7 and 4 is considered to be “at some risk” and a child scoring 3 or below is considered to be “at-risk”. On the Winter administration, this particular skill is noted to be “at some risk” if a child scores between a 24 and 10 and is considered “at-risk” if a child scores a 9 or below. All remaining children are considered to be at a “low risk” for problems with phonological awareness skills.

**Letter Naming Fluency (LNF) task.** Although the LNF task is not a measure of basic early literacy skills like the other DIBELS measures, being able to quickly recite letter names is predictive of later reading success. This task requires students to name as many letters as they can off of a page of upper-and lower-case letters arranged in random order for a total time of 1 minute. The student’s score is the number of letters named correctly in the designated amount of
time. On the Fall administration, a score falling between a 7 and 2 indicates “some risk” whereas a score of 1 or below identifies students who are “at-risk” for difficulty achieving early literacy benchmark goals. On the Winter administration of this subtest, a child earning a score between 26 and 15 is considered to be “at some risk” whereas a child earning a 14 or below is considered to be “at-risk”. Again, all children scoring higher than these cutoffs are considered to be at a “low risk” for problems with rapid naming skills.

**Phoneme Segmentation Fluency (PSF) task.** The PSF task is another measure of phonemic awareness that assesses a child’s skill at producing the individual sounds within a given word and is not administered until the Winter assessment period. A student must be able to segment three and four phoneme words into their individual phonemes fluently after the examiner orally presents the words to them. The number of correct phonemes produced in 1 minute determines the final score. A student is potentially “at some risk” for reading difficulty if he scores between a 17 and 7 and “at-risk” if he scores a 6 or below. Any child scoring above these designated cutoff scores is considered to be of a “low risk” for reading problems.

**A Developmental Neuropsychological Assessment-Second Edition (NEPSY-II).** The NEPSY-II is a comprehensive instrument designed to test the neuropsychological development of pre-school and school aged children (Korkman et al., 2007). According to the developers, the main purpose of the instrument is to reliably and validly identify deficits across and within six functional domains that can interfere with learning. These domains include Attention and Executive Functioning, Language, Memory and Learning, Social Perception, Sensorimotor, and Visuospatial Processing. Because most Learning Disorders involve deficits within phonological processing and executive functioning skills, the NEPSY-II’s specific referral battery for Learning Disorder assessment suggests administering subtests primarily within the Attention and
Executive Functioning and the Language Domains.

Domains of the NEPSY-II are theoretically derived based on Luria’s theory of brain dysfunction, where it is believed that combinations of different brain systems work together to manage complex cognitive functions. Because these domains are theoretically and not statistically derived, subtest scores rather than domain scores are used to determine a child’s strengths and weaknesses. Different subtests can yield a total of four different categories of scores, including primary scores (which represent the global aspects of the subtest), process scores (which assess more specific abilities), contrast scores (which allow clinicians to compare higher-level to lower-level cognitive functions statistically), and behavioral scores (which provide quantitative scores for common behaviors). The four categories of scores can be represented as scaled scores (M=10, SD= 3), percentile ranks, or cumulative percentages (Korkman et al., 2007).

Researchers have found moderate to high reliability for the NEPSY-II, including good specific subtest reliability (.50-.90) and good inter-rater reliability (.97-.99; Ahmed & Warriner, 2001; Hayes, 1998; Miller, 1998; Strauss et al, 2006). Researchers have also found ample evidence for high content and construct validity (Korkman et al., 2007; Schmitt & Wodrich, 2004; Strauss et al, 2006).

For the purposes of the present study, only the phonological processing, speeded naming, and inhibition subtests were used due to their hypothesized relationship with the DIBELS and relations to Learning Disorders. We were only interested in the Attention and Executive Functioning domain and the Language domains of this test.

**Phonological Processing subtest.** The Phonological Processing Subtest is categorized under the Language Domain of the NEPSY-II and is a measure of a child’s ability to recognize
the sound structure in words and to manipulate phonemes mentally (Korkman et al., 2007). The Phonological Processing subtest is composed of two different phonological processing tasks designed to assess phonemic awareness. The first task, Word Segment Recognition, requires the child to identify words from word segments. The child must be able to blend sounds into a word and link a specific word segment with a visual representation of a word. The second task, Phonological Segmentation, is a test of elision, assessing phonological processing of syllables and phonemes. In this task, the child is asked to repeat a word and then to create a new word by omitting or substituting either a word segment (syllable) or a letter sound (phoneme). Conceptually, this task should relate to both the DIBELS ISF and PSF subtests, as each of these subtests measures phonemic awareness.

Children are scored 1’s for correct answers and 0’s for incorrect answers. Upon completion of the subtest, the examiner totals the scores to obtain the raw score of the subtest and then converts this raw score into a primary scaled score. This primary scaled score is labeled the Phonological Processing Total Score and reflects the child’s overall performance across all items on this subtest. A score of 7 or below is considered low and thought to indicate poor phonological awareness and mental manipulation of phonemes.

*Speeded Naming subtest.* The Speeded Naming Subtest is also categorized under the Language Domain of the NEPSY-II and is a measure of a child’s lexical access and automaticity of verbal information, such as how quickly a child can identify and then produce names of colors, shapes, and sizes. In this task, a child is first shown an array of colors and shapes and then shown an array of colors, shapes, and sizes. Children are asked to name the color, shape, and/or size in order, as quickly as possible. This specific subtest should conceptually relate to the DIBELS LNF subtest, as both subtests are measures of verbal naming fluency.
Examiners record the amount of time it took the child to complete the task, as well as any mistakes the child made, including self corrections. The child is given 1 point for each correct and self corrected response and 0 points for any incorrect responses. A primary scaled score is yielded for the total completion time and a primary percentile rank is yielded for the total correct. These two primary scores are then integrated to produce the Speeded Naming Combined Scale Score. A score of 7 or below is considered low and may reflect problems with automaticity of naming, slow processing speed, and/or poor naming ability. For the purpose of this study, only the Speeded Naming Combined Scale Score was evaluated, as it balances both the speed and accuracy of the child’s performance.

Inhibition subtest. The Inhibition Subtest is categorized under the Attention and Executive Functioning Domain of the NEPSY-II and is a measure of multiple aspects of executive functioning including inhibitory control, cognitive flexibility, and self-monitoring. Specifically, this timed subtest is designed to assess a child’s ability to inhibit automatic responses in favor of novel responses. In this task, the child first completes a naming task where he looks at a series of black and white shapes or arrows and must name either the shape or the direction of the shape or arrow. The child then completes an inhibition task, where he must look at the same series of black and white shapes or arrows, but name the opposite shape or direction of the shape or arrow.

Examiners record the child’s completion time for each series and any errors the child makes. This subtest yields several different primary, combined, and contrast scores; however, for the purpose of this study, examiners only evaluated the Inhibition Combined score, which was produced from the integration of the total time on the inhibition tasks and the total number of errors made on the inhibition task. A score of 7 or below on this task may indicate poor
inhibitory control.
**Results**

All results were evaluated using the statistical software program SPSS 17.0. Prior to conducting the main statistical analyses, this researcher utilized pre-analysis data screening techniques to assess for missing data and outliers and to assess whether or not the data met the assumptions of independence and normality. Data was available for all 17 participants across all eight subtests. Although there appeared to be several outliers across the different subtests (i.e., seven in total), no cases were excluded from the sample, as all participants appeared to be representative of the intended sample and extreme scores did not appear to be due to instrumentation or data entry errors.

Although the participants in this data set were not randomly selected, the data still appeared to meet the assumption of independence. Because each participant in the study was administered the testing separately from others in the sample, it is very unlikely that the participants’ scores influenced each other. With regard to the assumption of normality, an examination of the distribution of scores suggested adequate variability with aggregate scores assuming a normal distribution for all subtests except for the DIBELS Fall ISF subtest. For this particular subtest, the distribution of scores was positively skewed, with 16 of the 17 children earning a score at or below 31. It appears that this subtest’s distribution of scores was skewed in this manner due to one child earning an extreme score of 64. Because the skewness in the distribution of scores was due to one case and not the overall sample, it appears that the variability of scores across all subtests was adequate for further analyses.

**Hypothesis 1: Relationship between the Fall DIBELS and Other Measures of Phonological Processing**

In order to assess whether or not scores from the fall administration of the DIBELS were positively correlated to another objective, standardized measure of phonological processing, this
researcher conducted Pearson product moment correlations between the DIBELS Fall ISF and the NEPSY-II Phonological Processing subtest scores and between the DIBELS Fall LNF and the NEPSY-II Speeded Naming subtest scores. Whereas the DIBELS Fall ISF and Phonological Processing scores were examined together because both tests are designed to measure phonological awareness and memory, the DIBELS Fall LNF and the NEPSY-II Speeded Naming subtest scores were examined together because both tests are designed to measure rapid naming abilities. The results of the correlational analyses indicated that both of the correlations were statistically significant (see Table 1). Correlations ranged from -0.66 to 0.88 and were medium to large in magnitude.

Table 1
*Means, Standard Deviations, and Bivariate Correlations Among DIBELS and NEPSY-II Subtest Scores (N=17)*

<table>
<thead>
<tr>
<th>Subtest</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.10</td>
<td>0.32</td>
<td>-0.03</td>
<td>0.36</td>
<td>-0.03</td>
<td>-0.11</td>
<td>0.47</td>
<td>0.38</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.48</td>
<td>-0.49*</td>
<td>-0.16</td>
<td>-0.49*</td>
<td>-0.16</td>
<td>-0.66*</td>
<td>-0.40</td>
<td>-0.18</td>
</tr>
<tr>
<td>1. DIBELS Fall ISF</td>
<td>_</td>
<td>0.75*</td>
<td>0.56*</td>
<td>0.62*</td>
<td>0.51*</td>
<td>0.58*</td>
<td>0.50*</td>
<td>0.52*</td>
</tr>
<tr>
<td>2. DIBELS Fall LNF</td>
<td>_</td>
<td>_</td>
<td>0.44</td>
<td>0.88*</td>
<td>0.62*</td>
<td>0.70*</td>
<td>0.74*</td>
<td>0.74*</td>
</tr>
<tr>
<td>3. DIBELS Winter ISF</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>0.28</td>
<td>0.51*</td>
<td>0.32</td>
<td>-0.03</td>
<td>-0.00</td>
</tr>
<tr>
<td>4. DIBELS Winter LNF</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>0.46</td>
<td>0.68*</td>
<td>0.80*</td>
<td>0.61*</td>
</tr>
<tr>
<td>5. DIBELS Winter PSF</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>0.41</td>
<td>0.36</td>
<td>0.40</td>
</tr>
<tr>
<td>6. NEPSY-II Phonological Processing</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
</tr>
<tr>
<td>7. NEPSY-II Inhibition</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>0.78*</td>
</tr>
<tr>
<td>8. NEPSY-II Speeded Naming</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
<td>_</td>
</tr>
</tbody>
</table>

Mean     | 20.35| 39.24| 33.35| 55.24| 35.76| 10.18| 10.71| 12.94|
SD       | 13.77| 19.52| 13.26| 20.08| 12.51| 4.42| 3.12| 3.44|

*p<.05

There was a significant positive relationship found between the DIBELS Fall ISF subtest scores and the NEPSY-II Phonological Processing subtest scores, *r*(15) = 0.58, *p*<.05, indicating
that children who were identified as having better phonological awareness and memory skills by
the DIBELS were also identified as having better phonological awareness and memory skills by
the NEPSY-II. A significant positive relationship was also found between the DIBELS Fall
LNF subtest scores and the NEPSY-II Speeded Naming subtest scores $r(15) = .74, p<.05$,
indicating that children who were identified as having better rapid naming abilities by the
DIBELS were also identified as having better rapid naming abilities by the NEPSY-II.

**Hypothesis 2: Relationship between the Fall DIBELS and a Measure of Executive
Functioning**

In order to assess whether or not scores from the Fall administration of the DIBELS were
positively correlated to an objective, standardized measure of executive functioning, this
researcher conducted Pearson product moment correlations between both the DIBELS Fall ISF
and LNF subtests with the NEPSY-II Inhibition subtest. The results of the correlational analyses
indicated that both of the correlations were statistically significant (see Table 1).

There was a significant positive relationship found between the DIBELS Fall ISF subtest
scores and the NEPSY-II Inhibition subtest scores, $r(15) = 0.50, p<.05$, and between the DIBELS
Fall LNF subtest score and the NEPSY-II Inhibition subtest score, $r(15) = .74, p<.05$, indicating
that children who performed higher on the DIBELS also performed higher on this NEPSY-II
subtest.

**Hypothesis 3: Relationship between Other Measures of Phonological Processing and the
Winter DIBELS**

In order to assess whether or not scores from other objective, standardized measures of
phonological processing were predictive of the Winter DIBELS subtests, this researcher
conducted Pearson product moment correlations between the NEPSY-II subtests of Phonological
Processing and Speeded Naming and the DIBELS Winter ISF, LNF, and PSF subtests. The results of these correlational analyses indicated that only two out of the six correlations were significant (see Table 1).

There was a significant positive relationship found between the NEPSY-II Speeded Naming subtest scores and the DIBELS Winter LNF subtest scores, $r(15) = 0.61, p<.05$, indicating that children who were identified as having better rapid naming skills by the NEPSY-II were later identified as having better rapid naming skills by the Winter DIBELS. A significant positive relationship was also found between the NEPSY-II Phonological Processing subtest scores and the DIBELS Winter LNF subtest scores, $r(15)= 0.68, p< .05$, indicating that children who were identified as having better phonological awareness skills by the NEPSY-II were later identified as having better rapid naming skills by the DIBELS. Thus, it appears that scores on the NEPSY-II Phonological Processing and Speeded Naming subtests administered in the fall predicted how well children would do on the Winter DIBELS LNF subtest.

Although not significant, positive relationships were also found between the NEPSY-II Phonological Processing subtest scores and both the DIBELS Winter ISF and PSF subtest scores, indicating that in general, the better a child performed on the NEPSY-II subtest, the better a child performed on the respective Winter DIBELS subtest. Furthermore, a positive, non-significant relationship was also found between the NEPSY-II Speeded Naming subtest scores and the DIBELS PSF subtest scores, indicating that the better a child performed on the NEPSY-II subtest measuring rapid naming abilities, the better the child performed on the second administration of the DIBELS PSF subtest.

**Hypothesis 4: Relationship between a Measure of Executive Functioning and the Winter DIBELS**
In order to assess whether or not scores from an objective, standardized measure of executive functioning were predictive of the Winter DIBELS subtests, this researcher conducted Pearson product moment correlations between the NEPSY-II Inhibition subtest and the DIBLES Winter ISF, PSF and LNF subtests. The results of these correlational analyses indicated that only one out of the three correlations was significant (see Table 1).

There was a significant positive relationship found between the NEPSY-II Inhibition subtest scores and the DIBELS Winter PSF subtest scores, \( r(15) = 0.61, p<.05 \), indicating that children who performed better on this particular NEPSY-II subtest also performed better on the Winter DIBELS PSF subtest. Relationships between the NEPSY-II Inhibition subtest and both the DIBELS Winter ISF and LNF were non-significant, with the ISF task actually displaying a negative relationship with the NEPSY-II Inhibition subtest, where children who performed higher on the DIBELS ISF subtest performed lower on the NEPSY-II Inhibition subtest.

**Additional Analyses: Relationship between the Fall and Winter DIBELS Administrations**

Children are generally expected to improve in their academic skills over the course of the academic year. Although not officially hypothesized, this researcher conducted two paired-sample t-tests in order to examine if DIBELS ISF and LNF scores significantly increased from the Fall to the Winter administrations. As expected, the results indicated that the mean Winter ISF score was significantly greater than the mean Fall ISF score, \( t(16)= -4.24, p<.05 \) and that the mean Winter LNF score was significantly greater than the mean Fall LNF score, \( t(16)= -6.77, p<.05 \) (see Table 2). The effect size indexes, \( d \), were 1.02 and 1.64, respectively, both of which indicate a large effect. The 95% confidence interval for the mean difference between the two scores was 6.50 to 19.50 and 10.99 to 21.01, respectively. These results indicate that children’s phonological processing skills improved significantly across the two administration periods.
In addition to examining whether or not scores significantly improved between the Fall and Winter administrations, this researcher also examined whether or not scores from the Fall and Winter administrations were positively correlated to each other. By conducting Pearson product moment correlations between the Fall and Winter DIBELS subtests, this researcher found that all five of the correlations between Fall and Winter DIBELS subtests were statistically significant (see Table 1).

**Table 2**

*Means and Standard Deviations for DIBELS Subtest Scores at Fall and Winter Administrations (N=17)*

<table>
<thead>
<tr>
<th>DIBELS Subtest</th>
<th>Fall Mean</th>
<th>Fall SD</th>
<th>Winter Mean</th>
<th>Winter SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISF</td>
<td>20.35</td>
<td>13.77</td>
<td>33.35</td>
<td>13.26</td>
</tr>
<tr>
<td>LNF</td>
<td>39.24</td>
<td>19.52</td>
<td>55.24</td>
<td>20.08</td>
</tr>
</tbody>
</table>

There was a significant positive relationship found between the DIBELS Fall and Winter ISF subtests, $r(15) = 0.56, p<.05$ and between the DIBELS Fall and Winter LNF subtests, $r(15) = 0.88, p<.05$. These results appear to indicate that children who performed higher on Fall DIBELS subtests measuring a specific skill area performed higher on the corresponding Winter DIBELS subtest as well. There were also significant positive relationships found between the DIBELS Fall ISF subtest and the Winter LNF subtest, $r(15) = 0.62, p<.05$, between the DIBELS Fall ISF subtest and the Winter PSF subtest, $r(15) = 0.51, p<.05$, and between the DIBELS Fall LNF subtest and the Winter PSF subtest, $r(15) = 0.62, p<.05$. These results appear to indicate that regardless of the specific skill being assessed, children who performed better on any of the Fall DIBELS subtests also generally performed better on the Winter DIBELS subtests.

**Hypothesis 5: Comparison of Risk Identification between the DIBELS and Other Measures of Phonological Processing and Executive Functioning**

In order to evaluate whether children identified as having risk concerns on the DIBELS
subtests also demonstrated greater problems on other measures designed to assess learning problems, independent-samples $t$ tests were conducted by comparing the mean difference scores on the NEPSY-II subtests for children identified as having any risk concerns (i.e., any child identified as “at some risk” or “at-risk”) on any of the DIBELS subtests with children who were identified as “low risk” on all of the DIBELS subtests. Risk concerns for the Fall and Winter administrations of the DIBELS were examined separately. Of the six total independent-samples $t$ tests that were conducted, none were significant. Table 3 displays the percentages of children identified as having risk concerns by the different DIBELS and NEPSY-II subtests.

Table 3
Percentages of Children Identified as Having Risk Concerns on the DIBELS and NEPSY-II Subtests

<table>
<thead>
<tr>
<th>Subtest</th>
<th>At Some Risk</th>
<th>At-Risk</th>
<th>Any Risk (At Some Risk + At-Risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Fall ISF</td>
<td>11.76%</td>
<td>2</td>
<td>0.00%</td>
</tr>
<tr>
<td>Fall LNF</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Fall Total</td>
<td>11.76%</td>
<td>2</td>
<td>0.00%</td>
</tr>
<tr>
<td>Winter ISF</td>
<td>29.40%</td>
<td>5</td>
<td>5.88%</td>
</tr>
<tr>
<td>Winter LNF</td>
<td>0.00%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>Winter PSF</td>
<td>5.88%</td>
<td>1</td>
<td>11.76%</td>
</tr>
<tr>
<td>Winter Total</td>
<td>35.29%</td>
<td>6</td>
<td>17.65%</td>
</tr>
<tr>
<td>Phonological Processing</td>
<td>-</td>
<td>-</td>
<td>5.88%</td>
</tr>
<tr>
<td>Speeded Naming</td>
<td>-</td>
<td>-</td>
<td>11.76%</td>
</tr>
<tr>
<td>Inhibition</td>
<td>-</td>
<td>-</td>
<td>29.40%</td>
</tr>
<tr>
<td>NEPSY-II Total</td>
<td>-</td>
<td>-</td>
<td>47.05%</td>
</tr>
</tbody>
</table>

Note: Risk identification for the DIBELS was determined by the test developers’ criteria. NEPSY-II risk was determined by using a scale score of $\leq 7$.

The first independent-samples $t$ test was conducted in order to assess whether there was a significant difference in NEPSY-II Phonological Processing scores for children who were identified as being “at some risk” or “at-risk” on any of the DIBELS Fall subtests with children
who were identified as “low risk” by all of the DIBELS Fall subtests. Levine’s test for equal variances was not significant, $p=.12$, therefore equal variances could be assumed. This $t$-test was not significant, $t(15)= -0.84$, $p=.41$, indicating that children identified as having risk concerns on the Fall DIBELS did not perform significantly different from children who were identified as “low risk” on the Fall DIBELS (see Table 4).

Table 4
*Fall and Winter DIBELS Risk Group Means, Standard Deviations, and Sample Sizes for NEPSY-II Subtests*

<table>
<thead>
<tr>
<th>DIBELS Group</th>
<th>NEPSY-II Subtest</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Phonological Processing</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>Fall Any Risk ($N=2$)</td>
<td>11.00</td>
</tr>
<tr>
<td>Fall Low Risk ($N=15$)</td>
<td>13.20</td>
</tr>
<tr>
<td>Winter Any Risk ($N=7$)</td>
<td>11.29</td>
</tr>
<tr>
<td>Winter Low Risk ($N=10$)</td>
<td>14.10</td>
</tr>
</tbody>
</table>

The second independent-samples $t$ test was conducted in order to assess whether there was a significant difference in NEPSY-II Phonological Processing scores for children who were identified as being “at some risk” or “at-risk” on any of the DIBELS Winter subtests with children who were identified as “low risk” by all of the DIBELS Winter subtests. Levine’s test for equal variances was not significant, $p=.16$, therefore equal variances could be assumed. This $t$-test was not significant, $t(15)= -1.77$, $p=.10$, indicating that children identified as displaying risk concerns on the Winter DIBELS did not perform significantly different from children who were identified as “low risk” on the Winter DIBELS (see Table 4).

The third independent-samples $t$ test was conducted in order to assess whether there was
a significant difference in NEPSY-II Speeded Naming scores for children who were identified as being “at some risk” or “at-risk” on any of the DIBELS Fall subtests with children who were identified as “low risk” by all of the DIBELS Fall subtests Levine’s test for equal variances was not significant, \( p = .31 \), therefore equal variances could be assumed. This test was also not significant, \( t(15) = -1.30, p = .21 \), indicating that children identified as being “at some risk” or “at-risk” on the Fall DIBELS did not perform significantly different from children who were identified as “low risk” on the Fall DIBELS (see Table 4).

The fourth independent-samples \( t \) test was conducted in order to assess whether there was a significant difference in NEPSY-II Speeded Naming scores for children who were identified as being “at some risk” or “at-risk” on any of the DIBELS Winter subtests with children who were identified as “low risk” by all of the DIBELS Winter subtests Levine’s test for equal variances was not significant, \( p = .36 \), therefore equal variances could be assumed. This test was also not significant, \( t(15) = -0.75, p = .46 \), indicating that children identified as being “at some risk” or “at-risk” on the Winter DIBELS did not perform significantly different from children who were identified as “low risk” on the Winter DIBELS (see Table 4).

The fifth independent-samples \( t \) test was conducted in order to assess whether there was a significant difference in NEPSY-II Inhibition scores for children who were identified as being “at some risk” or “at-risk” by any of the DIBELS Fall subtests with children who were identified as being at a “low risk” by all of the DIBELS Fall subtests. Levine’s test for equal variances was not significant, \( p = .61 \), therefore equal variances could be assumed. This test was also not significant, \( t(15) = -1.28, p = .22 \), indicating that children identified as having risk concerns on the Fall DIBELS did not perform significantly different from children who were identified as “low risk” on the Fall DIBELS (see Table 4).
The final independent-samples \( t \) test was conducted in order to assess whether there was a significant difference in NEPSY-II Inhibition scores for children who were identified as being “at some risk” or “at-risk” by any of the DIBELS Winter subtests with children who were identified as being at a “low risk” by all of the DIBELS Winter subtests. Levine’s test for equal variances was not significant, \( p = .96 \), therefore equal variances could be assumed. This test was also not significant, \( t(15) = -1.03, p = .32 \), indicating that children identified as having risk concerns on the Winter DIBELS did not perform significantly different from children who were identified as “low risk” on the Winter DIBELS (see Table 4).

Although none of the six independent samples \( t \)-tests were significant, the group means for children identified as having risk concerns by the DIBELS were lower than the group means for children identified as “low risk” by the DIBELS for all three NEPSY-II subtests (see Table 3). These results indicate that children who perform worse on the DIBELS also perform poorly on the NEPSY-II subtests, just not significantly so.

**Additional Analyses: Rate of Agreement in Risk Identification between the DIBELS and NEPSY-II Subtests**

When specifically examining the percentage of children who were identified as having any risk concerns (i.e., any child who was identified as “at some risk” or “at-risk”) by any of the Fall DIBELS and any of the NEPSY-II subtests, it appears as if the DIBELS and NEPSY-II subtests were in agreement only 5.9\% of the time (see Table 5). These measures were in agreement 58.8\% of the time in the identification of children not “at-risk”. The DIBELS appears to uniquely identify 5.9\% of the sample as having risk concerns whereas the NEPSY-II appears to uniquely identify 29.4\% of the sample as “at-risk”. Of the tests uniquely identifying children as having a risk concern, the DIBELS LNF and the NEPSY-II Phonological Processing subtest
did not uniquely identify any children, the DIBELS ISF and the NEPSY-II Speeded Naming subtest uniquely identified only one child, and the NEPSY-II Inhibition subtest uniquely identified three children.

When examining only the percentage of children who were identified as being “at-risk” on any of the DIBELS Fall subtests, the agreement of risk identification lowers to 0% and the agreement of children not “at-risk” increases to 64.71% (see Table 5). When examining the results in this manner, the NEPSY-II subtests appear to uniquely identify 35.29% of the children as “at-risk” whereas the DIBELS subtests do not appear to uniquely identify any children.

Table 5
*Fall Percentages of Children with Risk Concerns According to the DIBELS and NEPSY-II*

<table>
<thead>
<tr>
<th></th>
<th>DIBELS</th>
<th>NEPSY-II</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At-Risk</td>
<td>Not At-Risk</td>
</tr>
<tr>
<td>At Risk</td>
<td>0.00% (n=0)</td>
<td>35.29% (n=6)</td>
</tr>
<tr>
<td>Not At Risk</td>
<td>0.00% (n=0)</td>
<td>64.71% (n=11)</td>
</tr>
</tbody>
</table>
Discussion

Early identification of children “at-risk” for learning problems is vital to future academic success; thus, it is critical that educators and psychologists implement the most efficient and thorough assessment strategies with young children. In Oregon, the DIBELS is currently being administered to Kindergarten children as a universal assessment measure assessing for problems with reading ability. Although the DIBELS has shown some merit in this capacity (Burke et al., 2009; Elliott et al., 2001; Hintze et al., 2003; Kamps et al., 2003), it has rarely been compared to other standard measures that are frequently used to diagnose learning disorders. Additionally, little is known about the DIBELS’ relationship to other cognitive skills implicated in learning problems.

This current study sought to address these gaps in the literature by investigating which specific screening instruments could be used to identify young children “at-risk” for learning problems. Specifically, this study builds on the existing literature by attempting to validate the DIBELS in reference to other objective measures of phonological processing and executive functioning and by comparing risk identification of the DIBELS with these measures. Results from this study have the potential to enhance clinical and assessment knowledge by helping to determine which combinations of assessments for early identification of risk are best.

This next section summarizes the findings of the present study. An examination of the results of the research questions and additional analyses will be presented. Implications for early risk identification, limitations of this study, and directions for future research will also be discussed.

Summary

Overall, results appeared to indicate that although the DIBELS does map onto other measures of phonological processing and executive functioning, it may not be capturing all
children who are “at-risk” for potential learning problems. Results also suggested that most Winter DIBELS subtest scores could be predicted by other measures of phonological processing and executive functioning, as well as by the Fall DIBELS subtests. Furthermore, children appeared to improve significantly between the two administration periods of the DIBELS. In the following paragraphs, I will review and interpret results for specific hypotheses.

The first goal of the study was to examine the relationship of the Fall DIBELS subtests with other measures of phonological processing. As hypothesized, findings reveal that there were significant positive relationships between both Fall DIBELS subtests and the NEPSY-II subtests of Phonological Processing and Speeding Naming. These results suggest that the Fall DIBELS subtests and the NEPSY-II subtests are similarly measuring phonological processing abilities. These results are consistent with current literature, as the DIBELS has been validated with several other measures of phonological processing (Elliott et al., 2001; Hintze et al., 2003; Speece et al., 2003). However, the results of the study add to the literature in that the DIBELS has never before been validated with NEPSY-II subtests assessing phonological processing and naming ability.

These results have some implications for the assessment of learning disorders. First, these findings provide evidence of congruence between clinical and educational practices, meaning assessment procedures between these two settings may be capturing similar constructs. This is important for obtaining valid assessments in both settings. Second, the NEPSY-II subtests of Phonological Processing and Speeded Naming are much briefer to administer than is an entire battery assessing phonological processing. If the shorter NEPSY-II subtests provide just as much information as full length batteries, administration times could ultimately decrease, making universal screening for young children more feasible to educators and psychologists.
The second goal of the study was to examine the relationship of the Fall DIBELS with a measure of executive functioning. This particular goal sought to address the gaps in the literature regarding whether or not the DIBELS could provide information about other cognitive abilities. As hypothesized, findings reveal that there were significant positive relationships between both the Fall DIBELS subtests and the NEPSY-II subtest of Inhibition, which seeks to assess executive functioning skills such as inhibitory control, cognitive flexibility, and self-monitoring (Korkman et al., 2007). These results suggest that the Fall DIBELS subtests and the NEPSY-II Inhibition subtest might, to some extent, be measuring similar abilities needed for academic achievement. Thus, it is likely that the Fall DIBELS subtests are measuring some executive functioning skills in addition to phonological processing skills. This seems consistent with the demands of the DIBELS subtests, as they not only require the ability to phonologically process information, but also require children to mentally manipulate verbal information, a skill that would need to be managed by executive functions.

Executive functioning in young children has been fairly understudied, due to the fact that the fluid, dynamic nature of these skills is difficult to assess (Isquith & Gioia, 2004). Historically, only the NEPSY-II subtests within the Attention and Executive Functioning domain have been used to assess for problems in executive functioning that could lead to problems in learning. Therefore, these findings could have strong implications for the assessment of early risk identification, as the DIBELS may have more functionality in identifying various kinds of learning problems than was previously thought. Children whose learning problems were a result of executive functioning deficits would still be identified as “at-risk” even though these skills were not what the DIBELS was originally intended to measure. The DIBELS would then have the potential to be more effective in identifying any kind of learning disorder and would not need
to be given in combination with other kinds of learning disorder assessments. One important downside to these implications that should be considered, however, is that although the DIBELS may have the potential to identify more children with learning problems in various domains, the DIBELS may not necessarily reveal which specific skill(s) are actually impaired. Evaluators may then have to complete subsequent testing in order to determine in which skill area specific deficits lie.

Despite these promising implications, these results need to be interpreted with caution. One important note to consider is that the NEPSY-II Inhibition subtest does require children to rapidly name shapes and directions of arrows while also inhibiting automatic responses. Thus, a positive relationship between the DIBELS subtests and the NEPSY-II Inhibition subtest could be because the Inhibition subtest also requires the use of phonological processing and naming skills in order to be successful on the task. If this were the case, the Inhibition test, instead of the DIBELS, may have more potential to identify various kinds of learning disorders due to its ability to assess multiple kinds of cognitive skills.

Another important note to consider is that these two measures appear to be identifying different children as “at-risk”. This particular observation will be discussed later, but suggests that even though children who do well on one measure also do well on the other, the DIBELS and Inhibition subtests are not fully identifying the same specific skill deficits. This information is contradictory to what the results of the correlational analyses seemed to imply, indicating that although the DIBELS may be assessing some aspects of executive functioning, a measure that specifically targets executive functioning, such as the Inhibition subtest, provides unique information. Thus, it is likely that the DIBELS and Inhibition subtests are in fact not equally measuring the same cognitive skills. This would suggest that there may be some added benefit.
of pairing the Inhibition test with the DIBELS, as each measure seems to be capturing different kinds of cognitive weaknesses. Because of the contradictory information these results provide, they are not conclusive regarding whether or not the DIBELS can assess more than just pre-literacy skills. More research is needed in order to clarify this information.

The third and fourth goals of the study were to examine if other measures of phonological processing and executive functioning were predictive of Winter DIBELS subtest scores. As hypothesized, findings indicate that NEPSY-II subtests were predictive of the Winter DIBELS LNF and PSF subtests. Results also indicate, however, that the NEPSY-II subtests were not predictive of the Winter DIBELS ISF subtest. This pattern of results seems to suggest that the NEPSY-II subtests are tapping into similar abilities as the DIBELS subtests and that they can be used to determine performance at a later point in time, at least for the more complex early literacy skills. These results appear consistent with current literature that shows how academic ability at one point in time can predict academic achievement at a future point in time (Burke et al., 2009; Goffreeda, Diperna, & Pedersen, 2009).

Young children’s academic skills are expected to improve greatly over the course of a year (Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993; Hasbrouck & Tindal, 1992). In order to determine whether or not children generally improved from the Fall to the Winter DIBELS administration period, an additional analysis examining the relationship between the Fall and Winter DIBELS scores was conducted. As expected, the results indicate that children did significantly improve between the two administration periods, suggesting that these children were learning and improving in their academic skills over the course of the school year.

This finding of improved performance is consistent with the current literature (Fuchs et al., 1993; Hasbrouc'h & Tindal 1992). However, the participants of this study attend a private
school with a good academic curriculum, and this, in part, may have contributed to their vast improvement across the administration periods. Research has shown that educational environments can either be supportive of children’s academic success or contribute to further delays and deficits (Kamps, Ellis, Wyble, Greene, & Harvey, 1995). Additionally, it is possible that practice effects could have, in part, influenced the improvement between the two administration periods. Prior research on the DIBELS’s test-retest and alternate forms reliability, however, suggests that this was not the case (Burke et al., 2009; Elliott et al., 2001; Kaminski & Good, 1996; Kamps et al., 2003).

Additional analyses investigating the relationship between the Fall and Winter administrations of the DIBELS reveal that although children significantly improved between the two administrations, the Fall and Winter DIBELS subtests were highly positively correlated with each other. These findings are suggestive of the inherent stability of the DIBELS over time and reflect that children who perform well on the first administration also perform well on the second. These results are also consistent with current literature (Kaminski & Good, 1996), whereby children who perform better on Fall DIBELS subtests also perform better on criterion measures assessing the same skills.

The fifth research goal sought to investigate whether or not children identified as having any risk concerns on any of the DIBELS subtests also demonstrated greater problems on other measures designed to assess for learning difficulties. Although findings did not reveal any significant relationships between groups, group means on NEPSY-II subtests for children identified as having risk concerns by the DIBELS were lower than group means for children not identified as being “at-risk”. This suggests that children who perform poorly on the DIBELS also perform worse than their non “at-risk” peers on the NEPSY-II, indicating some overlap with
regard to the cognitive skills that the DIBELS and the NEPSY-II are supposedly measuring. However, because the findings were non-significant, any interpretation of these results would require replication.

One possible reason that the results for this analysis were not significant could be that the sample size of this study was too small. It is likely that with more statistical power, the results of this analysis would prove to be significant. Another possible reason for the lack of significant results that should also be considered, however, is that the DIBELS and NEPSY-II are actually not similarly measuring cognitive abilities, even in spite of some shared overlap.

As discussed previously and contradictory to the above information, the DIBELS and the NEPSY-II appear to be identifying different children as “at-risk”. A closer examination of the rate of agreement in risk identification between the DIBELS and NEPSY-II subtests reveals that the DIBELS and the NEPSY-II did not have a high agreement rate for identifying children “at-risk” for learning problems. These results indicate that each measure may be uniquely identifying different areas of concern. This suggests that despite having some overlap with regard to the cognitive skills assessed, the DIBELS may in fact, not be capturing children with all kinds of underlying learning problems and thus, should not solely be used in the screening process for identifying “at-risk” children. As was suggested previously, more information and future studies is needed to determine if this is indeed the case, as this study presents support for both scenarios (i.e., the DIBELS does assess more than just reading skills or that the DIBELS does not assess other academic skills).

Because the NEPSY-II subtests appear to be identifying many more children as “at-risk” than are the DIBELS subtests, administering the NEPSY-II subtests in combination with the DIBELS subtests could improve identification strategies for children “at-risk” for learning
problems. Of the NEPSY-II subtests, the test that appears to be contributing the most in early risk identification is the Inhibition subtest. Because this subtest may more specifically assess for executive functioning deficits that the DIBELS and other NEPSY-II subtests do not assess, this particular NEPSY-II subtest appears to contribute the most added value to early risk identification of children with learning problems. This provides evidence of the feasibility of examining executive functioning in early screenings for young children.

In summary, although the results from this study suggest that the DIBELS does in some ways relate well to other measures designed to assess for learning problems, it also appears that the DIBELS subtests may not be capturing all forms of learning problems that could eventually lead to learning disabilities. Thus, it appears as though administration procedures for identifying children “at-risk” for learning problems should also include measures that assess for other cognitive skills deficits. The NEPSY-II subtest of Inhibition appears to contribute well to the early identification of risk, and therefore, it is suggested that this subtest be administered alongside the DIBELS subtests in order to most effectively screen for learning problems.

Limitations

As with most other studies, this particular study is not without limitations. First, the sample size of this study was extremely small, making the generalizability of this study’s findings questionable. Additionally, although demographic characteristics of the sample were not specifically addressed, generalizability should also be questioned due to the lack of diversity within the sample (e.g., the fact that the sample was mostly White, from a middle class socio-economic status, from the same area of the country, and from the same school).

Another limitation of this study was that the NEPSY-II subtests and the DIBELS subtests were administered by different examiners. This raises a concern about the integrity and accuracy
of the data, as administration procedures may have varied between individual examiners across the different administration periods. Furthermore, because the NEPSY-II subtests were administered by graduate students in training, it is possible that the students’ lack of experience in administrating neuropsychological tests jeopardized the accuracy of data collection procedures. However, both students practiced prior to conducting the tests.

Future Directions

Future directions for this research should first address this study’s limitations by replicating this study with a much larger, diverse sample. By including more children from various backgrounds and preferably from different schools, whereby teaching strategies and school curricula would not directly influence the outcome, investigators may be able to make more generalized conclusions about the usefulness of the DIBELS and the NEPSY-II in identifying children “at-risk” for learning disorders.

Additionally, because results from this study seemed to support two contradictory scenarios for how the DIBELS does or does not relate to measures of executive functioning, future research investigating the DIBELS’s relation to other measures of executive functioning should be pursued. In order to avoid the possibility that the executive functioning measure may overlap with the DIBELS in regard to assessing pre-literacy skills, perhaps researchers could select a measure of executive functioning that does not require as many verbal fluency skills as the NEPSY-II subtest of Inhibition requires. This would enable researchers to make more sound conclusions about the DIBELS ability to detect problems in other cognitive areas.

Future studies should also investigate whether or not including other measures of cognitive and academic risk into assessment procedures could help increase the rate of identifying “at-risk” children. Even though the findings from this study appear to suggest that
the DIBELS and the NEPSY-II subtest of Inhibition will help to identify more young children “at-risk” for learning problems than will the DIBELS alone, it is important to note that the DIBELS and the Inhibition subtest are measures meant only to assess for underlying deficits in phonological processing and executive functioning skills, respectively. It is likely that this particular combination of assessments would still overlook many children “at-risk” for learning disorders due to underlying deficits in other skill areas. Although deficits in phonological processing and executive functioning skills are two of the major underlying causes of learning disabilities, deficits in other skills such as working memory, processing speed, and visual-spatial skills are also involved in learning difficulties.

Currently, there is little information regarding how the DIBELS relates to measures of risk that assess for underlying deficits of learning problems other than phonological processing and executive functioning deficits. Additionally, research is lacking in regard to which specific measures and which combinations of these kinds of assessments may most effectively and efficiently contribute to the “at-risk” screening process. In order for all children “at-risk” for learning problems to be identified early, before their learning difficulties lead to more significant academic struggles, it is extremely important that assessment procedures include measures that assess for all the potential underlying deficits of learning disorders.

Future research could also examine if and how the addition of behavioral checklists to early assessment procedures contributes to the identification of “at-risk” children. Because children with learning problems also often display behavior problems, it would be interesting to see how measures like the DIBELS relate to assessments of behavioral risk. Additionally, it would be interesting to examine whether or not teacher ratings of academic achievement are useful in the identification of academic risk. Such studies may provide information about how
teacher’s observations relate to standardized assessments of risk and about what kinds of learning deficits are the most and least overtly identifiable.

In addition to examining how the DIBELS relates to other measures of academic and behavioral risk, future research could also examine if the “at-risk” categories identified in this study have any meaning in the real world. Researchers could conduct a criterion-based evaluation whereby children’s grades and report cards would serve as a true criterion for real world outcomes (i.e., doing poorly in school and having low grades). It could then be determined how the “at-risk” categories identified via testing relate to performance in a real world classroom.

In order to determine the added value of administering the NEPSY-II in combination to the DIBELS, it would also be pertinent to conduct longitudinal studies with young children across their academic careers. This would allow researchers to examine if the combination of the NEPSY-II and the DIBELS helped to identify more children who would later go on to develop learning disabilities than just the DIBELS alone. Because this particular study did not investigate whether or not the children identified as “at-risk” by the DIBELS and the NEPSY-II subtests did in fact develop learning disabilities or difficulties later in their schooling, the accuracy of each of these measures in identifying children as “at-risk” is purely speculative. It would be interesting to investigate sensitivity and specificity rates of these measures in order to determine their true effectiveness. Moreover, longitudinal studies would also be important to conduct because some children in this study who were identified early may be false positives, meaning that they do not have true learning disorders. These children may be developmentally immature and will “age out” of their difficulties over time. Longitudinal studies would help to elucidate these processes.
Another important aspect of early risk identification that this particular study did not address was what procedures would need to be followed if a child was identified as “at-risk”. In order to make sure that these children achieve the best outcomes, it would be crucial for educators, psychologists, and parents to know the appropriate steps for intervening. For instance, after controlling for level and kind of risk, it would be important to know if better outcomes resulted from educators merely observing a child identified as “at-risk” and assessing him at a later point in time or if better outcomes resulted from the child being immediately referred for further assessment. Once more effective assessment protocols and subsequent procedures for “at-risk” children are developed, children with various kinds of learning problems will have an increased chance of being successful academically.

Finally, despite the fact that this particular study yielded a good deal of information about assessment strategies in and of themselves, this study did not investigate how these children’s teachers and parents perceived the assessment process. Because teachers and parents are typically the most involved members of a child’s life and have the most potential to positively impact a child’s life, it is important that assessment measures provide them with useful and easily understood information. It would be important to know if results from the DIBELS and the NEPSY-II were consistent with the parents’ and teachers’ views of the child, if the measures provided additional information to them, and if the results and feedback of the measures were useful in determining how to intervene with the child. Furthermore, investigations into what information parents and teacher find most helpful versus what is perceived as confusing could help psychologists and educators to tailor the feedback of assessment measures in the most effective way, something that could increase the possibility for successful intervention.
Conclusions

Findings from research studies such as this one have the potential to influence assessment strategies and procedures implemented with young children. Thus, it is extremely important that research investigating the best assessment practices for identifying young children “at-risk” for learning problems be pursued. The results of this study have strong implications for the assessment and evaluation strategies educators and psychologists may use when attempting to identify young children “at-risk” for learning problems. Although the findings of this study indicate that the DIBELS has merit in its own right, the findings of this study also appear to suggest that administering the DIBELS in combination with the NEPSY-II subtest of Inhibition will allow for more children “at-risk” for various kinds of learning disorders to be identified earlier in their academic careers, before learning disabilities have the chance to develop or worsen. Because the DIBELS is one of the main assessments currently being administered in the process of screening young children for learning problems in the state of Oregon, it is extremely important that educators and psychologists attempt to understand the extent of its usefulness and effectiveness in identifying “at-risk” children. Furthermore, it is imperative that research into the best assessment strategies for the early identification of risk for learning problems be continued in order to ensure that all children are given the opportunity to grow and thrive in a school environment as best they can.
References


Oregon Reading First Center. (2010). *DIBELS Data System*. Retrieved from https://dibels.uoregon.edu


