Novice Teachers' Knowledge of Reading-related Disabilities and Dyslexia

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Current understandings about the nature of persistent reading problems have been influenced by researchers in numerous fields. Researchers have noted that a current and accurate understanding of reading disabilities, such as dyslexia, can be helpful in assessing, teaching and supporting individuals with persistent reading problems. The purpose of this exploratory study was to examine novice teachers' knowledge about characteristics of reading disability and dyslexia and whether or not certification type, certification grade level and/or exposure to reading content predicted teacher knowledge. Participants (n=271) were enrolled in undergraduate and graduate teacher preparation programs across the United States, and were asked to identify characteristics of reading disability and dyslexia. Responses were analyzed qualitatively and quantitatively. Findings revealed that teachers had accurate understandings when asked about reading disability, but misconceptions when asked about dyslexia. Certification type, certification grade level, and exposure to reading content did not predict accurate understandings of reading disability or dyslexia; however, certification grade level did predict misconceptions about dyslexia.

Keywords: **Reading Disabilities, Teacher Knowledge, Teacher Preparation**

INTRODUCTION

The ability to read, and to do so with both accuracy and comprehension, is no doubt a needed life-long skill. Many children will learn to read with seeming ease, however some experience persistent difficulty (Chall & Jacobs, 2003; Liberman & Liberman, 1990; Juel, 1988; Torgesen et al., 2001). Unfortunately, those who have persistent difficulty learning to read are also likely to experience secondary and long-term factors related to reading difficulty such as negative social and emotional impacts (Alexander-Passe, 2006, 2015; Novita, 2016; Riddick, Sterling, Farmer, & Morgan, 1999), dropping out of school and/or limited access to job and career possibilities (Hernandez, 2011). Fortunately, advances in the fields of neuroscience, psychology, and education have informed our understanding of why some individuals struggle pervasively with reading (Torgesen, 2002; Velluntino, Fletcher, Snowling, & Scanlon, 2004). Additionally, research has underlined the crucial role teachers play in providing children, specifically children with reading difficulties, with necessary and

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appropriate reading instruction (Pressley & Allington, 1995; Snow, Burns, & Griffin, 1998; Snow, Griffin, & Burns, 2005; Taylor, Pressley, & Pearson, 2000).

In their research report, *Preventing Reading Difficulties in Young* Children, the National Academy of Science Committee Council (Snow et al., 1998), concluded that "quality classroom instruction in kindergarten and the primary grades is the single best weapon against reading failure" (p. 343). Because school is often the first context where difficulty with reading occurs, researchers have proposed that in order for teachers to assess appropriately, target instructional needs, and identify evidence-based strategies they need to not only have strong content knowledge about teaching reading but also an accurate and research-based understanding of the nature of reading difficulties (Lyon & Weiser, 2009; Moats, 1994; Moats, 2009, 2014; Spear-Swerling, 2016; Spear-Swerling & Cheesman, 2012; Torgesen, 2002). As literacy demands increase in the 21st century (Drew, 2012) and standards, such as the Common Core State Standards (CCSS, National Governors Association Center for Best Practices, 2010), place expectations for teachers across grade levels and disciplines for literacy learning the need for *all* teachers to have accurate knowledge about reading difficulties is as important as ever. In fact, Turner, Applegate, and Applegate (2009) argued that "teachers in every classroom in the United States" should be "literacy leaders" (p. 254). However, researchers and educators have questioned the extent to which teachers have access to research-based information about reading difficulties in teacher preparation and continuing education contexts (Gray, 2008; Hudson, High, & Al Otaiba, 2007; Joshi, Binks, Hougen, Dahlgren, Ocker-Dean, & Smith, 2009; Siedenberg, 2013; Washburn et al., 2016; Williams & Lynch, 2010).

Despite a growing consensus that teacher knowledge plays an important role in children and adolescents receiving effective reading instruction (Cheesman, McGuire, Shankweiler, & Coyne, 2009; McCutchen et al., 2002; McCutchen, Green, Abbott, & Sanders, 2009; Piasta, Connor, Fishman, & Morrison, 2009; Spear-Swerling, 2009), little research, to date, has been published on what teachers know about reading difficulties. Therefore, the purpose of the present study was to explore what novice teachers, in a variety of school contexts (general education, special education, elementary, secondary), know about reading difficulties.

Nature of Reading Difficulties

Various terms have been used to describe persistent reading difficulties with "dyslexia" and "reading disability" most commonly used and often interchangeably (Velluntino et al., 2004; Youman & Mather, 2013). Researchers have proposed that dyslexia is one type of reading disability (Gough & Tunmer, 1986; Tunmer & Greaney, 2008) and that reading disabilities are best conceptualized on a continuum. Specifically, the Simple View of Reading (SVR) (Hoover & Gough, 1990) can be used to define and describe the reading disability continuum. In the SVR, reading (R) is defined as the product of both decoding (D) and oral language comprehension (C) or $D \times C = R$ and reading disability is described as consisting of three broad (and continuous) categories that result from poor decoding skills, weaknesses in comprehending language, or both. Individuals who have persistent difficulty learning to decode words despite having received evidence-based instruction and intervention, but who have strong language comprehension are referred to as individuals with dyslexia

(Tunmer & Greaney, 2010). Individuals who can decode accurately but have difficulty making meaning of a text are described as having specific reading comprehension difficulties (Nation & Norbury, 2005). A third category represents individuals who have problems with both decoding and oral language comprehension and have been referred to as "garden variety" poor readers (Gough & Tunmer, 1986) or as a having a mixed reading disability (Catts & Kamhi, 2005).

Individuals with dyslexia represent the largest group of individuals with a reading disability (Shaywitz, 1998; Siegal, 2006). Though there is not one universally agreed upon definition of dyslexia, the National Institute of Health (NIH) recognizes the definition published by Lyon, Shaywitz and Shaywitz (2003):

> Dyslexia is a specific learning disability that is neurological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. (p. 2)

Dyslexia is also developmental (Peterson & Pennington, 2012) and differs in severity (Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992); thus indicators may change as children get older and/or receive targeted instruction. Brain-imaging studies have also provided evidence that intensive, explicit, systematic and contextualized (time spent applying skills to text reading) instruction in phonological awareness and decoding strategies can lead to more fluent reading for individuals with dyslexia (Gabrieli, 2009). Though much research has informed our current understanding of dyslexia, the general public often has misconceptions about the characteristics of dyslexia (Hudson et al., 2007; Williams & Lynch, 2010). Hudson et al. (2007) noted seven common misunderstandings about dyslexia: (a) writing letters and words backwards are symptoms of dyslexia, (b) reading disabilities are caused by visual perception problems, (c) children will outgrow dyslexia, (d) more boys than girls have dyslexia, (c) dyslexia only affects individuals who speak English, (e) people with dyslexia will benefit from colored text overlays or lenses, and (f) a person with dyslexia can never learn to read. Researchers (Berninger, Nielsen, Abbott, Wijsman, & Raskind, 2008; Moats, 1994, 2009) have reported that these misconceptions, if held by teachers, may be detrimental to ensuring that children and adolescents with persistent reading problems receive timely and appropriate intervention.

Organizations such as the International Dyslexia Association (IDA) as well as state legislative efforts have pushed for teacher preparation programs and professional development endeavors to include accurate, recent, and research-based information on the characteristics of reading disability and dyslexia. Specifically, IDA has published a set of standards that outline what teachers need to know about the nature of reading disability and defining characteristics of dyslexia (see Knowledge and Practice Standards for Teachers of Reading, IDA, 2010). These standards were designed to be used to guide teacher preparation and professional development. Additionally, grass-roots groups such as Decoding Dyslexia have placed increasing

pressure on state governments to enact legislation that require teacher preparation programs and school systems (for professional development of practicing teachers) to include training on the nature of reading disabilities and the characteristics of dyslexia. As a movement to spread awareness of, and decrease misunderstandings about, reading disability and dyslexia gains momentum, the need to investigate what teachers know is timely.

Teacher Knowledge of Reading Disability and Dyslexia to Date

Though few studies, to date, have been published on teacher knowledge of reading disability and dyslexia, the inquiry is not necessarily new. In 1982, Allington measured teachers' knowledge and perceptions of the characteristics and causes of dyslexia. Allington reported that the majority of teachers he surveyed believed that children experienced persistent problems acquiring basic readings skills because of deficits in visual perception. Allington quoted Lefton (1978) in support for the lack of evidence to support the visual deficit hypothesis by stating: "we should disregard the notion of perceptual deficits…reading disabled children make errors, but not because they cannot discriminate letters" (p. 233 as cited in Allington, 1982).

Over twenty years later, Wadlington and Wadlington (2005) constructed a questionnaire, Dyslexia Belief Index (DBI), that included 30 statements about dyslexia including both accurate understandings and common myths and 4 statements about participants' perceptions about their preparation to work with individuals with dyslexia. Two-hundred and fifty educators in a university-based department of education (teacher educators, general and special education preservice teachers, and K-12 school administrators) participated in the study. Almost all participants in that study demonstrated accurate knowledge of dyslexia concerning the separation between intelligence and dyslexia (96%) and that one's home literacy environment is independent of dyslexia (97%). However, a majority of participants (69%) held the misconception that word reversal is the main criterion in diagnosing dyslexia. Participants (88%) also reported that they had not been prepared to work with individuals with dyslexia.

Building off the work of Wadlington and Wadlington (2005), Washburn and colleagues surveyed preservice and inservice teachers in the United States (Washburn, Joshi, & Binks-Cantrell, 2011a, 2011b) and in England (Washburn, Binks-Cantrell, & Joshi, 2014). In all three studies, the researchers reported that teachers demonstrated accurate knowledge as well as misconceptions concerning dyslexia. For example, Washburn et al. (2011a, 2011b) reported that the majority of pre-service and in-service teachers understood that individuals with dyslexia often experience difficulty with language-based activities (decoding, spelling). Yet at the same time, an overwhelming majority of teachers in both studies indicated that colored overlays and/or tinted lenses would help individuals with dyslexia. In Washburn et al. (2014), the researchers explored English and American pre-service teachers' knowledge of dyslexia. As in the first two studies, Washburn et al. (2014) reported that both groups of pre-service teachers shared the understandings that dyslexia is not caused by home environment and that poor spelling is a characteristic. The American and English pre-service teachers also shared the misconception that seeing letters and words backwards is a characteristic of dyslexia.

Ness and Southall (2010) used a grounded theory approach to analyze responses to a short open-ended questionnaire in which pre-service teachers were asked to define and list traits of dyslexia. Much like the previously noted studies, pre-service teachers responded with some accurate knowledge (e.g., 33% noted difficulty with fluency; 30% noted dyslexia is a reading disability) about dyslexia but the majority responded with misconceptions about dyslexia. For instance, 74% of pre-service teachers noted letter reversal while 40% attributed reading and/or writing words in the wrong order as characteristics of dyslexia.

Analysis of these studies revealed that teachers, like the general public, may hold misconceptions about dyslexia. However, if dyslexia is thought to be one type of reading disability (Tumner & Greaney, 2008), we found it interesting that researchers have not yet explored what teachers know about reading disability, in general. Could teachers' misconceptions be related to the often misunderstood word, 'dyslexia' (Elliott & Grigorenko, 2014), rather than to an overall understanding of reading difficulties? Thus, in the present study we sought to explore what teachers know about reading difficulties when asked about characteristics of both reading disabilities and dyslexia. Additionally, we aimed to extend the current research base in two other ways. First, we conducted both quantitative and qualitative analysis of the survey items. The use of a mixed approach to data analysis allowed us to explore the data for purposes of both "breadth and depth of understanding and corroboration" (Johnson, Onwuegbuzie & Turner, 2007, p. 123). And second, we explored whether or not certification area (general education or special education), certification grade level (elementary or secondary), and amount of exposure to reading related content[1] predicted teacher knowledge. To our knowledge, the amount of exposure to reading related content has not been explored as a possible predictor of teacher knowledge in published research on teacher knowledge of dyslexia. The recent push in many states for all teachers, not just specialized teachers (i.e., Reading Specialists), to receive training on the nature of reading disabilities and dyslexia makes this aspect of our study relevant and timely.

To guide the present study, we posed the following research questions: (1) What do novice teachers know about reading disability and dyslexia? And upon qualitative analysis of the data, do patterns concerning teacher understandings and misunderstandings about reading disability and dyslexia exist? (2) Does teacher certification area, certification grade level, or amount of exposure to reading-related content predict teacher knowledge of reading disability or dyslexia?

METHODS

Data Source

The survey used in this exploratory study was adapted from one used in previous studies (Washburn et al., 2011a; Washburn et al., 2011b) and constructed to measure teacher knowledge and skill of basic language constructs and knowledge

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1   In this study, the amount of exposure to reading-related content is defined as the number of literacy courses previously taken by the participant. One literacy course was considered to be a full-semester, credit bearing course and different from a stand-alone training or professional development. This distinction was made for participants in the demographic section of the survey.

of dyslexia. The current survey was revised to include additional reading-related concepts such as fluency, word study, vocabulary, and comprehension. Further, the survey was revised to include open-response questions about reading disability and dyslexia, replacing multiple true/false items. Because the purpose of this study was to examine teacher knowledge of the characteristics associated with reading disability and dyslexia, we focused our analysis on two open-ended items from the survey: (a) What are characteristics of reading disability? and (b) What are characteristics of dyslexia? It should be noted that these two items were in different parts of the 32 item survey. The reading disability item appeared early on in the survey (item #11), right after the demographic section, and the dyslexia item towards the end (item #29).

Participants and Research Sites

All participants (n =271) for the present study were novice teachers enrolled in eight college- or university-based teacher education programs from five states (representing the Southwest, Southeast, mid-Atlantic and Northeast regions of the United States). For the purpose of this study, we use the term *novice* to describe individuals who have 0-5 years of teaching experience and are seeking initial or additional certification in general or special education. Though the term *novice* is typically associated with practicing teachers new to the profession (i.e., within first 5 years of teaching), we decided to make the term *novice* more inclusive after examining participants' characteristics (see Table 1 for a breakdown of those characteristics). As noted in Table 1, one-fourth of the participants held a certification during this study. With regard to teaching experience, 229 (84.5%) of participants had no formal teaching experience, 26 (9.6%) had 1-2 years of teaching experience and 16 (5.9%) had 3-5 years of teaching experience. Specifically, 134 (91%) of general education participants and 95 (77%) of special education participants had no formal teaching experience, while 6 (4%) of general education participants and 20 (16%) of special education participants had 1-2 years of teaching experience. Participants also had a range of exposure to reading or literacy-related coursework: 75 (28%) had not previously taken a literacy course, 64 (24%) had taken one literacy course, 56 (21%) had taken two literacy courses, 34 (12%) had taken three literacy courses and 42 (15%) had taken four or more courses. General education teachers, on average, had taken 2.18 literacy courses whereas special education teachers, on average, had taken 1.49 literacy courses. Thus, general education teachers (M=2.18, SD=2.31) had taken a significantly greater number of literacy courses than special education teachers (M=1.49, SD=1.47) (t[269] = 2.88, $p < .004$, $d = 0.35$). When grade level was considered, there was no significant difference in the number of literacy courses taken between elementary (M=1.85, SD=1.78) and secondary (M=1.91, SD=2.4) teachers.

Table 1. *Participant Characteristics*

	Whole Group (n=271)	General Education (n=148)	Special Education (n=123)
	n (%)		
Undergraduate	140 (51.7)	73 (49.3)	67 (54.5)
Graduate	131 (48.3)	75 (50.7)	56 (45.5)
Elementary	183 (67.5)	79 (53.4)	104 (84.6)
Secondary	88 (32.5)	69 (46.6)	19 (15.4)
Currently holds certification	70 (25.8)	28 (18.9)	42 (34.1)

Procedure

Participants were recruited using both purposive and convenience sampling. Purposive sampling is non-probability sampling and is used to target specific groups of participants with similar characteristics (Onwuegbuzie & Collins, 2007). Sampling was purposive because we wanted to recruit participants that were novice teachers (0-5 years of teaching experience) who were seeking initial or additional certification in general or special education and at either the elementary or secondary levels so as to explore teachers who, given recent initiatives and standards, were more likely to have been exposed to coursework on reading difficulties. Our sampling was also convenient because we contacted colleagues who taught education courses at institutions of higher education across the United States and asked if they would serve as a facilitator for participant recruitment and survey administration at their perspective institutions. For each participating institution, the researchers first contacted the Institutional Review Board (IRB) to obtain permission to collect data. Some IRBs required additional human subjects review through their institutions, while others relied on the human subjects review at the researchers' home institution.

Representative facilitators at each campus administered a paper survey to potential participants, which was expected to take approximately 30 minutes to complete. Surveys were administered in undergraduate and graduate courses in special education and/or literacy, with supervision provided by the facilitators (i.e., campus-affiliated colleagues of the authors). Following administration, surveys were returned to us in pre-addressed envelopes for data entry and analysis.

Research Design and Data Analysis

An exploratory mixed methods design was used to answer both of the research questions (Creswell & Plano-Clark, 2007). In an exploratory mixed methods design, data often begin as qualitative and then either additional quantitative data are collected or the initial qualitative data are transformed for quantitative analysis. The latter is the case in the present study.

To answer Research Question One, *What do teachers know about reading disability and dyslexia? And upon qualitative analysis of the data, do patterns concerning*

teacher understandings and misunderstandings about reading disability and dyslexia exist?, data were first analyzed qualitatively using a constant comparative approach (Glaser & Strauss, 1967). The constant comparative method is an inductive process in which the researchers examine and compare units of data to identify commonalities or themes that may exist in the corpus of data. In order to constantly compare data, participants' responses were first broken into individual units of analysis. One unit of analysis was considered to be one complete thought or concept (e.g., trouble with fluency, sees things backwards). Therefore, a participant's response could include more than one unit of analysis. For example, the response "problems with reading fluency and reading comprehension" would be coded as two units of data. Units of data were then reviewed using an open coding procedure approach in which the first three authors independently reviewed each response, gave each unit a label or preliminary code, and then discussed individual codes to come up with a final theme. This process was repeated for each unit of analysis for every participant's responses to the two items. A list of 21 themes emerged for the Reading Disability (RD) question and 18 themes for the Dyslexia question. Next, each list of themes was collapsed into five overarching categories using axial coding. Axial coding is the process of examining themes with the goal of looking for relationships and/or similarities. During this process, we identified five overarching categories: Language/Literacy, Behavior, Cognition, Misconceptions, and Other Characteristics. To illustrate the process of axial coding, when a participant responded to either of the questions with information about language-related processes such as oral language, reading or writing the theme was collapsed into the "Language/Literacy" category. Themes were placed into the "Behavior" category if the unit included an aspect of non-reading behaviors (e.g., attention, motivation, frustration). Themes placed in the "Cognition" category had to do with cognitive processes that were not reading specific (e.g., memory). Themes placed in the "Misconceptions" category involved common misunderstandings about reading disabilities and dyslexia. There were three reoccurring themes in the misconceptions category for both the reading disability and dyslexia item. For example, "sequencing" encompassed participant responses such as reading backwards. The theme "letter reversals" is also included in this category. Though some children with dyslexia may reverse letters, this behavior is also observed in beginning readers and writers (Cassar, Treiman, Moats, Pollo, & Kessler, 2005) and is not a defining characteristic of dyslexia (Lyon et al., 2003) nor is it discussed in the SVR. Also included in the misconceptions category is "visual perception", which included participant responses such as seeing letters "jump around" or seeing letters and words backwards. Although the role of visual perception in dyslexia has been explored and theorized by researchers (Vellutino et al., 2004), it is currently understood that reading difficulties are associated with phonological processing and not visual deficits. The category of "Other characteristics" consisted of themes that did not belong in the first four categories (e.g., reading below grade level) but are often associated with persistent reading problems. For example, "reading below grade level" was identified as a characteristic of both reading disability and dyslexia. Though a child or adolescent with dyslexia may read below grade (Catone & Brady, 2005), it is not a characteristic specifically associated with "Language/Literacy", "Behavior" or "Cognition" categories. In addition to the five categories, a separate category was created for non-responders. While all

teachers responded to at least one of the items, 32 teachers (11.8%) did not provide a response to the RD item and 59 teachers (21.8%) did not provide a response for the Dyslexia item.

Data were then analyzed relative to the SVR (Gough & Tunmer, 1986; Tunmer & Greaney, 2010) and the Lyon et al. (2003) definition of dyslexia. Tables 2 and 3 provide an overview of categories and themes for RD and Dyslexia and sample responses for each category.

To answer Research Question Two, *Does teacher certification area, certification grade level, or amount of exposure to reading-related content predict teacher knowledge of reading disability or dyslexia?,* all themes were first entered into a statistical software package (SPSS) as individual variables. Next, each theme received a value, either a zero or a one. A one was given to a theme if the response contained the theme and a zero was given if the response did not contain the theme. For example, the response to the RD item "Inability to comprehend what they read and difficulties with decoding the written word" was coded as containing the comprehension and decoding theme. Therefore, this participant received a one for the comprehension variable and a one for the decoding variable. This process was repeated for all coded responses for both the RD and Dyslexia item. Once all theme variables were completed, category variables were created by adding up all of the specific themes relative to a category for a total. For example, the language/literacy category for RD consists of 10 themes (see Figure 1 for specific themes). Using the previous example, the participant would have a total of two (one for comprehension and one for decoding) in the language/literacy category variable. Once this process was complete, frequency counts were calculated to examine how the data were distributed across themes and categories. Frequency counts first revealed that, based on the total number of themes in a category, the category variables could be refined even further. Therefore, we recoded the category variables from scale or continuous variables to nominal variables with the following coding scheme: 0 = no response, 1 = one theme, >1 = more than one theme. Additionally, frequency counts for both the RD and Dyslexia items revealed that the majority of participants' responses contained themes from two categories: language/literacy and misconceptions. Thus, we concentrated our next set of analyses on these two categories.

To examine whether or not certification area, certification grade level, and/or amount of exposure to reading-related content predicted teacher knowledge, two sets of multinomial regression analyses were conducted: one set of analyses for the RD item and one set for the Dyslexia item. In each set, six individual multinomial regression analyses were conducted. The first set of multinomial regression analyses were conducted for the RD item with the language/literacy category as the dependent variable and certification area as the independent variable. Next, we conducted multinomial regression with the language/literacy category as the dependent variable and certification grade level as the independent variable. The third analysis was conducted with the language/literacy category as the dependent variable and number of literacy courses as the independent variable. Analyses four, five and six mirrored the first three but with the misconceptions category as the dependent variable. The second set of multinomial regression analyses were conducted for the Dyslexia item and all six analyses were conducted in the same grouping of dependent and independent variables as the RD item.

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Table 2. *Categories*, Themes, and Sample Responses for the Reading Disability item*

Language/Literacy	
Speech/Pronunciation	"struggling with pronunciation of words"
Phonological Awareness	"low phonemic awareness"
Grammar	"inability to segment and blend words"
Vocabulary	"grammar is lacking"
Background Knowledge	"misunderstanding vocabulary"
Decoding	"little known background knowledge"
Fluency	"Difficulty with reading fluency, comprehension or phonics (putting together sounds or words)."
Comprehension	"difficulty comprehending readings"
Substitutions	"substituting words for other words"
Spelling	"difficult time with spelling"
Behavior	
Attention/Focus	"unable to stay focused"
	"lack of attention"
Motivation	"has low motivation"
	"lack of interest"
Cognition	
Transfer/Maintenance	"not able to make connections with what was taught even though taught numerous times"
Memory	"has difficulty remembering what was read"
Misconceptions	
Sequencing	"reading things backwards"
Letter Reversals	"writing letters and numbers backwards or the wrong order"
Visual Perception	"seeing letters or words backwards; especially black ink on white paper"
Other Characteristics	
Below Grade Level	"reads below grade level"
Dyslexia	"low scores on screening tests"
Heredity	"is dyslexia"
Developmental	"sometimes reading disability runs in the family"
	"significant delay in the reading"

Note. *The overarching categories are in bold.

Table 3. *Categories*, Themes, and Sample Responses for the Dyslexia item*

Category	Sample Responses
Language/Literacy	
Speech/Pronunciation	"mispronouncing words"
Phonological Awareness	"limited phonological awareness"
Grammar	"students have many errors in their grammar"
Decoding	"poor decoding skills"
Fluency	"slow reading fluency"
Comprehension	"good listening comprehension"
Substitutions	"substitutes words for other words"
Spelling	"spelling difficulties"
Handwriting	"handwriting errors"
Behavior	
Frustration	"frustration/anger when asked to read or write"
Motivation	"low motivation"
	"lack of interest in reading"
Cognition	
Brain	"slower processing"
Differences/Processing	"only part of the brain is activated"
Concentration	"inability to concentrate during reading"
Misconceptions	"mixes up letter placement when reading and spelling"
Sequencing	"reversed letters, words, or numbers"
Letter Reversals	"switching letters such as b and d around"
Visual Perception	"seeing letters on page moving"
Other Characteristics	
Below Grade	"low achievement not low intelligence"
Level/Discrepancy	"born with it"
Heredity	"genetic element (probably runs in family)"

Note. *The overarching categories are in bold.

<div align="center">RESULTS</div>

Responses to the Reading Disability Item

Inductive analysis of the responses to the RD item revealed 21 themes. The 21 themes were further sorted into five overarching categories: language/literacy, behavior, cognition, misconceptions, and other characteristics. In Table 4 we provide a breakdown of frequency of response for each category and theme for reading disability for the whole group of participants and for certification area and certification grade level. When examining the data for patterns, we found that the majority of participants' responses were in the language/literacy category with general and special education teachers having similar percentages of responses in this category. When the data were disaggregated by certification grade level, elementary teachers had slightly higher percentage of responses in the language/literacy category than secondary teachers. Upon further examination of the data, we found that seventy-three percent of all participants ($n = 198$) responded with at least one of ten identified characteristics of reading disability related to difficulty with language/literacy as reflected in the SVR. Of the total sample ($n = 271$), 66 (24.4%) responded with one characteristic of language/literacy, 74 (27.3%) responded with two characteristics, 45 (6.6%) with three characteristics, and 13 (4.8%) with four or more characteristics. The majority of those responses were split among three specific characteristics: decoding (32.1%), fluency (33.9%), and comprehension (43.2%). When the data were disaggregated by certification area, elementary teachers had a higher percentage of responses in themes such as decoding and fluency than secondary teachers. However, secondary teachers had a higher percentage of responses in comprehension.

As for the four remaining categories, whole group response rates ranged from 8-12% with behavior at 8.9%, cognition at 10%, misconceptions at 12.2% and other characteristics at 9.6%. In Table 5 we provide an even simpler breakdown of the data by grouping participants' responses into one of three groups based on the number of responses per category (>1, 1, or 0). This grouping also allowed us to conduct the logistic regression analyses needed to answer the second research question.

A series of multinomial regression analyses (n=6) were conducted to examine if certification area, certification grade level, or amount of exposure to reading-related content (number of literacy courses taken) predicted teacher knowledge of characteristics of language/literacy or misconceptions associated with reading disability. None of the six models were significant. Thus certification area, certification grade level, or number literacy courses were not significant predictors of teacher knowledge of language/literacy nor misconceptions of reading disability.

Table 4. *Frequency of Response for Each Category* and Theme for Reading Disability for Whole Group, Certification area and Certification level groups*

	Whole Group (n=271)	General Education (n=148)	Special Education (n=123)	Elementary (n=183)	Secondary (n=88)
	% (n)				
Language/Literacy	73.0 (198)	73.0 (108)	74.8 (92)	76.5 (140)	68.2 (60)
Speech/Pronunciation	10 (27)	8.1 (10)	12.2 (15)	10.9 (20)	8.0 (7)
Phonological Awareness	14 (38)	8.8 (13)	20.3 (25)	17.5 (32)	6.8 (6)
Grammar	1.8 (5)	2.0 (3)	1.6 (2)	2.2 (4)	1.1 (1)
Vocabulary	8.9 (24)	8.8 (13)	8.9 (11)	9.8 (18)	6.8 (6)
Background Knowledge	2.2 (6)	2.7 (4)	1.6 (2)	1.6 (3)	3.4 (3)
Decoding	32.1 (87)	30.4 (45)	34.1 (42)	34.4 (63)	27.3 (24)
Fluency	33.9 (92)	32.4 (48)	35.8 (44)	38.3 (70)	25.0 (22)
Comprehension	43.2 (117)	47.3 (70)	38.2 (47)	41.0 (75)	47.7 (42)
Substitutions	2.2 (6)	2.0 (3)	2.4 (3)	1.6 (3)	3.4 (3)
Spelling	3.7 (10)	4.1 (6)	3.3 (4)	4.4 (8)	2.3 (2)
Behavior	8.9 (24)	11.5 (17)	5.7 (7)	8.2 (15)	10.2 (9)
Attention	4.4 (12)	6.1 (9)	2.4 (3)	3.3 (6)	6.8 (6)
Motivation	4.8 (13)	8.1 (9)	3.3 (4)	5.5 (10)	3.4 (3)
Cognition	10.0 (27)	10.1 (15)	9.8 (12)	9.3 (17)	11.4 (10)
Transfer/Maintenance	2.2 (6)	3.4 (5)	.8 (1)	1.1 (2)	4.5 (4)
Memory	7.7 (21)	6.8 (10)	8.9 (11)	8.2 (15)	6.8 (6)
Misconceptions	12.2 (33)	10.1 (15)	14.6 (18)	9.8 (18)	17.0 (15)
Sequencing	4.1 (11)	3.4 (5)	4.9 (6)	3.8 (7)	4.5 (4)
Letter Reversals	5.9 (16)	4.7 (7)	7.3 (9)	5.5 (10)	6.8 (6)
Visual Perception	3.7 (10)	3.4 (5)	4.1 (5)	2.2 (4)	6.8 (6)
Other Characteristics	9.6 (26)	10.1 (15)	8.9 (11)	10.9 (20)	6.8 (6)
Below Grade Level	3.0 (8)	3.4 (5)	2.4 (3)	3.8 (7)	1.1 (1)
Dyslexia	6.3 (17)	6.1 (9)	6.5 (8)	6.6 (12)	5.7 (5)
Heredity	0.7 (2)	1.4 (2)	0.0 (0)	1.1 (2)	0.0 (0)
Developmental	0.7 (2)	1.4 (2)	0.0 (0)	1.1 (2)	0.0 (0)

Note. *The overarching categories are in bold.

Table 5. *Frequency of Response for Each Category for Reading Disability across Groups*

	Whole Group (n=271)	General Education (n=148)	Special Education (n=123)	Elementary (n=183)	Secondary (n=88)
			n (%)		
Language/ Literacy					
>1	132 (48.7)	71 (48)	61 (49.6)	93 (50.8)	39 (44.3)
1	66 (24.4)	35 (23.6)	31 (25.2)	45 (24.6)	21 (23.9)
0	73 (26.9)	42 (28.4)	31 (25.2)	45 (24.6)	28 (31.8)
Behavior					
>1	1 (.4)	1 (.7)	--	1 (.5)	--
1	23 (8.5)	16 (10.8)	7 (5.7)	14 (7.7)	9 (10.2)
0	247 (91.1)	131 (88.5)	116 (94.3)	168 (91.8)	79 (89.8)
Cognition					
>1	--	--	--	--	--
1	27 (10)	15 (10.1)	12 (9.8)	17 (9.3)	10 (11.4)
0	244 (90)	133 (89.9)	111 (90.2)	166 (90.7)	78 (88.6)
Misconceptions					
>1	4 (1.5)	2 (1.4)	2 (1.6)	3 (1.6)	1 (1.1)
1	29 (10.7)	13 (8.8)	16 (13)	15 (8.2)	14 (15.9)
0	238 (87.8)	133 (89.9)	105 (85.4)	165 (90.2)	73 (83)
Other Characteristics					
>1	2 (.7)	2 (1.4)	--	32 (17.5)	11 (12.5)
1	24 (8.9)	13 (8.8)	11 (8.9)	41 (22.4)	25 (28.4)
0	245 (90.4)	133 (89.9)	112 (91.1)	110 (60.1)	52 (59.1)

Note. >1 = more than one theme mentioned in response; 1 = a single theme mentioned in response; 0 = no theme was mentioned in response; -- indicates no

Responses to the Dyslexia Item

Inductive analysis of the responses to the dyslexia item revealed 18 themes. The themes were then sorted into the same five overarching categories as the RD item: language/literacy, behavior, cognition, misconceptions and other characteristics. In Table 6 we provide a breakdown of frequency of response for each category and theme for dyslexia for the whole group of participants and for certification area

and certification level. The majority of participants' responses were in two categories: "language/literacy" and "misconceptions". In the "language/literacy" category, general education teachers had higher percentages of responses than special education teachers. When disaggregated by certification grade level, the percentages of responses in the "language/literacy" category were alike. Upon further examination of the "language/literacy" category, we found that 40% of participants ($n = 162$) responded with at least one of nine identified characteristics of dyslexia related to difficulty with language/literacy. Of the total number of participants ($n = 271$), 66 (24.4%) responded with one characteristic of language/literacy, 28 (10.3%) responded with two characteristics, 13 (4.8%) with three characteristics, and 2 (0.7%) with four or more characteristics. The majority of those responses were split among three specific characteristics commonly associated with reading instruction: decoding (17.7%), fluency (10.7%), and comprehension (12.5%); 2% of participants responded with all three of those characteristics. Again, general education teachers had higher percentage of responses in these characteristics/themes than special education teachers. When data were disaggregated by certification grade level, percentage of responses in these specific themes were comparable.

In the category of misconceptions, general and special education teachers had similar percentages of responses. However, when the data were further disaggregated by grade level secondary teachers had a higher percentage of responses in the misconception category than elementary teachers. Upon further examination, 53% of participants ($n=145$) responded with at least one misconception about dyslexia. As noted in Table 3, the *misconceptions about dyslexia* category consisted of three themes: sequencing (i.e., reading letters or words backwards or out of sequence), visual perception (i.e., seeing letters backwards or letters jumping around), and letter reversal (i.e., reversing letters in written expression). Of the total number of participants, 81 (29.9%) included sequencing, 38 (14%) visual perception, and 81 (29.9%) letter reversal in their response to the Dyslexia item. Response rates were much lower for the three remaining categories (behavior, cognition, and other characteristics) ranging from 3-5%. See Table 7 for the >1, 1, and 0 grouping of responses for each category for the Dyslexia item across groups.

As with the RD item, a series of multinomial regression analyses (n=6) were conducted to examine if certification area, certification grade level, or amount of exposure to reading-related content (number of literacy courses taken) predicted teacher knowledge of characteristics of language/literacy or misconceptions associated with dyslexia. Five of the six models were not significant. However, one model was significant: certification grade level and misconceptions ($\chi^2(2) = 9.448$, $p = .009$, Nagelkerke $R^2 = .039$). Thus, certification grade level was a significant predictor of misconceptions. When examining the descriptive data, it can be noted that participants with or working towards secondary grade level certification had higher percentages, overall and in individual themes, in the misconceptions category.

Table 6. *Frequency of Response for Each Category* and Theme for Dyslexia for Whole Group, Certification area and Certification level groups*

	Whole Group (n=271)	General Education (n=148)	Special Education (n=123)	Elementary (n=183)	Secondary (n=88)
	% (n)				
Language/Literacy	40.2 (109)	43.2 (64)	36.6 (45)	39.9 (73)	40.9 (36)
Speech/Pronunciation	4.1 (11)	3.4 (5)	4.9 (6)	3.3 (6)	5.7 (5)
Phonological Awareness	4.1 (11)	2.7 (4)	5.7 (7)	5.5 (10)	1.1 (1)
Grammar	0.7 (2)	0.7 (1)	0.8 (1)	1.1 (2)	0.0 (0)
Decoding	17.3 (47)	18.9 (28)	15.4 (18)	17.5 (32)	17.0 (15)
Fluency	10.7 (29)	13.5 (20)	7.3 (9)	10.9 (20)	10.2 (9)
Comprehension	12.5 (34)	15.5 (23)	8.9 (11)	12.6 (23)	12.5 (11)
Substitutions	1.1 (3)	1.4 (2)	0.8 (1)	0.5 (1)	2.3 (2)
Spelling	9.6 (26)	8.8 (13)	10.6 (13)	1.5 (21)	5.7 (5)
Handwriting	1.1 (3)	0.7 (1)	1.6 (2)	1.6 (3)	0.0 (0)
Behavior	4.0 (11)	6.8 (10)	0.0 (0)	3.3 (6)	4.5 (4)
Frustration	1.8 (5)	3.4 (5)	0.0 (0)	2.2 (4)	1.1 (1)
Motivation	2.2 (6)	4.1 (6)	0.0 (0)	1.6 (3)	3.4 (3)
Cognition	3.6 (10)	6.8 (10)	1.6 (2)	4.4 (8)	4.5 (4)
Brain Differences/ Processing	1.8 (5)	2.7 (4)	0.8 (1)	1.6 (3)	2.3 (2)
Concentration	1.8 (5)	2.7 (4)	0.8 (1)	1.6 (3)	2.3 (2)
Misconceptions	53.5 (145)	54.1 (80)	52.8 (65)	47.5 (87)	65.9 (58)
Sequencing	29.9 (81)	31.8 (47)	27.6 (34)	26.8 (49)	36.4 (32)
Letter Reversals	29.9 (81)	29.7 (44)	30.1 (37)	24.0 (44)	42.0 (37)
Visual Perception	14.0 (38)	14.2 (21)	13.8 (17)	13.7 (25)	14.8 (13)
Other Characteristics	3.0 (8)	2.0 (3)	4.1 (5)	3.8 (7)	1.1 (1)
Below Grade Level	1.8 (5)	1.4 (2)	2.4 (3)	2.2 (4)	1.1 (1)
Heredity	1.1 (3)	0.7 (1)	1.6 (2)	1.6 (3)	0.0 (0)

Note. *The overarching categories are in bold.

Table 7. *Frequency of Response for Each Category for Dyslexia across Groups*

	Whole Group (n=271)	General Education (n=148)	Special Education (n=123)	Elementary (n=183)	Secondary (n=88)
			n (%)		
Language/ Literacy					
>1	43 (15.9)	26 (17.6)	17 (13.8)	32 (17.5)	11 (15.9)
1	66 (24.4)	38 (25.7)	28 (22.8)	41 (22.4)	25 (28.4)
0	162 (59.8)	84 (56.8)	78 (63.4)	110 (60.1)	52 (59.1)
Behavior					
>1	2 (.7)	2 (1.4)	--	1 (.5)	1 (1.1)
1	8 (3)	8 (5.4)	--	5 (2.7)	3 (3.4)
0	261 (96.3)	138 (93.2)	123 (100)	177 (96.7)	84 (95.5)
Cognition					
>1	--	--	--	--	--
1	12 (4.4)	10 (6.8)	2 (1.6)	8 (4.4)	4 (4.5)
0	259 (95.6)	138 (93.2)	121 (98.4)	175 (95.6)	84 (95.5)
Misconceptions					
>1	52 (19.2)	31 (20.9)	21 (17.1)	28 (15.3)	24 (27.3)
1	93 (34.3)	49 (33.1)	44 (35.8)	59 (32.2)	34 (38.6)
0	126 (46.5)	68 (45.9)	58 (47.2)	96 (52.5)	30 (34.1)
Other Characteristics					
>1	1 (.4)	1 (.7)	--	1 (.5)	--
1	7 (2.6)	2 (1.4)	5 (4.1)	6 (3.3)	1 (1.1)
0	263 (97)	145 (98)	118 (95.9)	176 (96.2)	87 (98.9)

Note. >1 = more than one theme mentioned in response; 1 = a single theme mentioned in response; 0 = no theme was mentioned in response; -- indicates a frequency of 0.

Discussion

In this study, we examined what novice teachers (n=271) in teacher education undergraduate and graduate programs across the United States knew about reading difficulties when are asked about characteristics of reading disability and dyslexia. Qualitative and quantitative analysis of teachers' responses revealed that the majority of teachers in our study (73%), when asked "What are characteristics of reading

disability?", had responses listing at least one or more language and literacy-related characteristic (see Table 4). Certification area, certification grade level, or exposure to literacy-related content did not predict teacher knowledge of reading disability. Though not significant, it is notable that elementary teachers had higher percentages of responses in the decoding and fluency themes and secondary teachers had a higher percentage of responses in the theme of comprehension. These reading-related skills are relative to their teaching contexts. That is, elementary teachers, especially in Kindergarten through grade 3, focus instruction on students learning to read, whereas secondary teachers focus instruction on using reading to help students learn content. Because the aspect of asking teachers about reading disability is novel to this research base, we were unable to compare our findings to the research base.

However, analysis of the Dyslexia item displayed a different pattern of responses than was demonstrated on the RD item and findings were comparable to other published studies (e.g., Ness & Southall, 2010; Wadlington & Wadlington, 2005; Washburn et al., 2011a, 2011b, 2014). For example, 40% of teachers noted at least one characteristic related to language or literacy: decoding (17%), fluency (11%), comprehension (12 %), and spelling (10%) (see Table 6). This finding was almost identical to Ness and Southall (2010) with regard to decoding, comprehension and spelling, however a higher percentage of pre-service teachers in their study (33%) responded with "issues with fluency" (p. 39). Though it is encouraging that 40% of teachers' responses included a language or literacy-related response, we were surprised that only 4% noted difficulty with phonological awareness as a characteristic of dyslexia (see Table 6). This finding, however, is not unique and similar percentages were reported in Ness and Southall (2010) and in Washburn et al. (2011a, 2011b).

As in other studies, we found that many teachers' responses included misconceptions about dyslexia. Specifically, 54% of all teachers reported one or more misconceptions about dyslexia. Interestingly enough, other researchers (Wadlington & Wadlington, 2005; Washburn et al., 2011a, 2011b) have reported higher percentages of teacher misconceptions about dyslexia. In studies of pre-service and in-service teachers, Washburn et al. (2011a, 2011b) reported that 92% of pre-service and 91% of in-service teachers answered either "probably true" or "definitely true" to the statement, "seeing letters and words backwards is a characteristic of dyslexia". Wadlington and Wadlington (2005) reported that approximately 70% of teachers indicated on the DBI that "word reversal is the major criterion in the identification of dyslexia" (p. 23). Additionally, in our study, teacher certification and number of literacy courses were not significant predictors of teacher knowledge of language/literacy characteristics or misconceptions of dyslexia. However, certification grade level was a significant predictor with secondary teachers' responses containing a higher percentage of misconceptions. This is not surprising as teachers at the secondary level are more likely to take a course in content area literacy than literacy instruction and/or assessment where topics such as reading difficulties may be more likely (Snipes & Horwitz, 2008). Further, Wadlington and Wadlington (2005) reported a similar finding in that elementary teachers performed significantly better than secondary teachers in their study on the DBI. It ought to be noted that there were teachers' responses, across certification grade levels and certification types, that included both accurate understandings and misconceptions about dyslexia in their responses. Overall, results

indicated that, regardless of certification area, certification grade level, or number of literacy courses taken, novice teachers in this study listed more language and literacy related characteristics with the term *reading disability* than with the term *dyslexia.* As this body of research builds, it appears that there is confusion among teachers about what dyslexia is and is not.

There are some limitations that should be considered relative to our data. First, the data do not reflect a nationally representative, random sampling technique. Furthermore, the sample did not include participants from institutions of higher education in the northwestern region of the United States. Next, the open-ended nature of the dyslexia and reading disabilities questions may have restricted responses (as evidenced by a 12% non-response rate for reading disability and 22% for dyslexia). Third, the inclusion of both questions may have served to distract or confuse participants, which may have affected their responses. Simply seeing the term *reading* in the reading disability question may have helped participants in responding more accurately. Finally, we intended to investigate the knowledge of specialized reading teachers and literacy specialists as well; however, we removed their data from the study due to insufficient sample size (n=18).

IMPLICATIONS AND CONCLUDING THOUGHTS

The current study adds to the teacher knowledge research base, and its exploratory nature lays the groundwork for further investigation. Future research should investigate the knowledge of more veteran teachers, to determine if experience, professional development, or other factors may play a role in knowledge acquisition. Adding more questions related to reading disability and dyslexia, including other types of questions (e.g., multiple choice, application) may provide a more-in-depth understanding of the issue. Studies could also be conducted to investigate the knowledge and perceptions of reading teachers, literacy specialists, and school psychologists as well as teacher-educators. This would be a particularly important as in most schools, where a school-wide approach (e.g. Response to Intervention [RtI]) to working with striving readers has become more commonplace (Jimerson, Burns, & VanDerHeyden, 2016). Interestingly, only one of the states from which our sample was drawn has laws related to dyslexia identification, intervention, teacher training and professional development. Therefore, investigations of the knowledge and perceptions of teachers in states with dyslexia laws as compared to those teachers in states without dyslexia laws would shed some light on the impact of the policies on teacher education practice. As reforms in education related to literacy and special education sweep across the nation, the knowledge and perceptions may change in a few years. Replicating this study in five to ten years may net very different results.

Finally, we recognize that because the survey was administered to novice teachers with a limited number of courses or no previous coursework in literacy or reading-related issues, the results may be reflective of persistent misconceptions among the general public rather than teacher preparation programs. However, across the nation, certification requirements are often minimal for literacy coursework. Regardless of the source of the misconceptions, we believe teacher educators have a responsibility to provide up-to-date, accurate information to novice teachers. Accordingly, teacher professional development should include a focus on providing accurate

and timely information related to reading-related concepts, reading disability, and dyslexia. As teacher educators who have dedicated our careers to supporting striving learners, we believe that such measures are critical to dispelling the myths associated with dyslexia and empowering teachers to make informed decisions for their readers who experience significant and persistent difficulty.

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Alexander-Passe, N. (2006). How Dyslexic teenagers cope: An investigation of self-esteem, coping and depression. *Dyslexia, 12*, 256-275.

Alexander-Passe, N. (2015). The dyslexia experience: Difference, disclosure, labelling, discrimination and stigma. *Asia Pacific Journal of Developmental Differences*, *2*, 202-233.

Allington, R. (1982). The persistence of teacher beliefs in facets of the visual perceptual deficit hypothesis. *The Elementary School Journal, 82*, 351-359.

Berninger, V. W., Nielsen, K. H., Abbott, R. D., Wijsman, E., & Raskind, W. (2008). Writing problems in developmental dyslexia: Under-recognized and under-treated. *Journal of School Psychology*, *46*, 1-21.

Budin, S. G., Mather, N., & Cheesman, E. (2010). Examining promising practices to improve linguistic knowledge and inform practice in teacher education. *Perspectives on Language and Literacy, 36*, 13-17.

Carlsen, W. S. (1991). Subject-matter knowledge and science teaching: A pragmatic perspective. *Advances in Research on Teaching, 2*, 115-143.

Cassar, M., Treiman, R., Moats, L., Pollo, T. C., & Kessler, B. (2005). How do the spellings of children with dyslexia compare with those of nondyslexic children? *Reading and Writing: An Interdisciplinary Journal, 18*, 27-49.

Catone, W. V., & Brady, S. A. (2005). The inadequacy of individual educational program (IEP) goals for high school students with word-level reading difficulties. *Annals of Dyslexia, 55*, 53-78.

Catts, H. W., & Kamhi, A. G. (Eds.). (2005). *The connections between language and reading disabilities.* Mahwah: NJ: Erlbaum.

Chall, J. S., & Jacobs, V. A. (2003). Poor children's fourth-grade slump. *American Educator, 27*, 14-17.

Cheesman, E.A., McGuire, J.M., Shankweiler, D., & Coyne, M. (2009). First-year teacher knowledge of phonemic awareness and its instruction. *Exceptional Children, 32*, 270-289.

Creswell, J. W., & Clark, V. L. P. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage Publications.

Cunningham, A. E., Perry, K. E., Stanovich, K. E., & Stanovich, P. J. (2004). Disciplinary knowledge of K-3 teachers and their knowledge calibration in the domain of early literacy. *Annals of Dyslexia, 54*, 139-167.

Drew, S. V. (2012). Open Up the Ceiling on the Common Core State Standards: Preparing Students for 21st--Century Literacy—Now. *Journal of Adolescent & Adult Literacy*, *56*, 321-330.

Elliott, J. G., & Grigorenko, E. L. (2014). *The dyslexia debate.* Cambridge University Press.

Gabrieli, J. D. (2009). Dyslexia: a new synergy between education and cognitive neuroscience. *Science, 325*, 280-283.

Glaser, B. G., & Strauss A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine Publishing Company.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education, 7*, 6-10.

Gray, E. S. (2008). Understanding dyslexia and its instructional implications: A case to support intense intervention. *Literacy research and instruction*, *47*, 116-123.

Hernandez, D.J. (2011). Double jeopardy: How third grade reading skills and poverty influence high school graduation. New York: The Annie E. Casey Foundation.

Hoover, W. A., & Gough, P. B. (1990). The simple view of reading. *Reading and writing: An Interdisciplinary Journal*, *2*, 127-160.

Hudson, R. F., High, L., & Al Otaiba, S. (2007). Dyslexia and the brain: What does current research tell us? *The Reading Teacher*, *60*, 506-515.

International Dyslexia Association (2010). *Knowledge and practice standards for teachers of reading*. Baltimore, MD: IDA.

Jacobs, V. (2008). Adolescent literacy: Putting the crisis in context. *Harvard Educational Review*, *78*, 7-39.

Jimerson, S. R., Burns, M. K., & VanDerHeyden, A. M. (2016). *Handbook of response to intervention*. New York: Springer US.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, *1*, 112-133.

Liberman, I. Y. & Liberman, A. M. (1990). Whole word vs. code emphasis: Underlying assumptions and their implications for reading instruction. *Bulletin of the Orton Society, 40*, 51-76.

Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2003). A definition of dyslexia. *Annals of Dyslexia*, *53*, 1-14.

Mather, N., Bos, C., & Babur, N. (2001). Perceptions and knowledge of preservice and inservice teachers about early literacy instruction. *Journal of Learning Disabilities*, *34*, 472-482.

McCutchen, D., Abbott, R. D., Green, L. B., Beretvas, S. N., Cox, S., Potter, N. S., Gray, A. (2002). Beginning literacy: Links among teacher knowledge, teacher practice, and student learning. *Journal of Learning Disabilities, 35,* 69-86.

McCutchen, D., Green, L., Abbott, R. D. & Sanders, E.A. (2009). Further evidence for teacher knowledge: Supporting struggling readers in grades three through five. *Reading and Writing: An Interdisciplinary Journal, 22*, 401-423.

Moats, L. C. (1994). The missing foundation in teacher education: Knowledge of the structure of spoken and written language. *Annals of Dyslexia*, *44*, 81-102.

Moats, L. (2009). Knowledge foundations for teaching reading and spelling. *Reading and Writing: An Interdisciplinary Journal*, *22*, 379-399.

Moats, L. (2014). What teachers don't know and why they aren't learning it: Addressing the need for content and pedagogy in teacher education. *Australian Journal of Learning Difficulties*, 19, 1-17. doi: 10.1080/19404158.2014.941093

Nation, K., & Norbury, C. F. (2005). Why reading comprehension fails: Insights from developmental disorders. *Topics in Language Disorders*, *25*, 21-32.

National Governors Association Center for Best Practices, Council of Chief State School Officers (2010). *Common core state standards: English language arts*. Washington D.C.: Authors.

Ness, M. K., & Southall, G. (2010). Preservice teachers' knowledge of and beliefs about dyslexia. *Journal of Reading Education*, *36*, 36-43.

Novita, S. (2016). Secondary symptoms of dyslexia: a comparison of self-esteem and anxiety profiles of children with and without dyslexia. *European journal of special needs education*, *31*, 279-288.

Onwuegbuzie, A. J., & Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *The qualitative report*, *12*, 281-316.

Peterson, R. L., & Pennington, B. F. (2012). Developmental dyslexia. *The Lancet*, *379*, 1997-2007.

Piasta, S. B., Connor McDonald, C., Fishman, B. J., & Morrison, F. J. (2009). Teachers' knowledge of literacy concepts, classroom practices, and student reading growth. *Scientific Studies of Reading, 13*, 224-248.

Riddick, B., Sterling, C., Farmer, M., and Morgan, S. (1999). Self-esteem and anxiety in the educational histories of adult dyslexic students." *Dyslexia, 5*, 227-248.

Shaywitz, S. E. (1998). Dyslexia. *New England Journal of Medicine, 338*, 307-312.

Shaywitz, S. E., & Shaywitz, B. A. (2005). Dyslexia (specific reading disability). *Biological Psychiatry, 57*, 1301-1309.

Shaywitz, S. E., Fletcher, J. M., Holahan, J. M., Shneider, A. E., Marchione, K. E., Stuebing, K. K., & Shaywitz, B. A. (1999). Persistence of dyslexia: The Connecticut longitudinal study at adolescence. *Pediatrics, 104*, 1351-1359.

Siedenberg, M. (2013). The science of reading and its educational implications. *Language Learning and Development, 9*, 331-360.

Siegel, L. S. (2006). Perspectives on dyslexia. *Paediatrics & Child Health, 11*, 581-587.

Snipes, J., & Horwitz, A. (2008). *Advancing adolescent literacy in urban schools.* Washington, DC: Council of the Great City Schools.

Snow, C. E., Burns, M. S., & Griffin, P. (Eds.). (1998). *Preventing reading difficulties in young children.* Washington D.C.: National Academies Press.

Snow, C., Griffin, P., & Burns, M. S. (Eds.). (2005). *Knowledge to support the teaching of reading: Preparing teachers for a changing world.* San Francisco: John Wiley & Sons.

Spear-Swerling, L. (2009). A literacy tutoring experience for prospective special educators and struggling second graders. *Journal of Learning Disabilities, 42*, 431-443.

Spear-Swerling, L. (2016). Common types of reading problems and how to help children who have them. *The Reading Teacher, 69*, 513-522.

Spear-Swerling, L., & Cheesman, E. (2012). Teachers' knowledge base for implementing response-to-intervention models in reading. *Reading and Writing, 25*, 1691-1723.

Stotsky, S. (2009). Licensure tests for special education teachers: How well they assess knowledge of reading instruction and mathematics. *Journal of Learning Disabilities, 42*, 464-474.

Taylor, B.M., Pressley, M.P., & Pearson, P.D. (2000). *Research-supported characteristics of teachers and schools that promote reading achievement.* Washington, D.C.: National Education Association, Reading Matters Research Report.

Torgesen, J. K., Alexander, A. W., Wagner, R. K., Rashotte, C. A., Voeller, K. K., & Conway, T. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of learning disabilities, 34*, 33-58.

Turner, J.D., Applegate, M.D., & Applegate, A.J. (2009). Teachers as literacy leaders. *The Reading Teacher, 63*, 254-256.

Tunmer, W., & Greaney, K. (2010). Defining dyslexia. *Journal of Learning Disabilities, 43*, 229-243.

Tunmer, W. E., & Greaney, K. T. (2008). Reading intervention research: An integrative framework. In G. Reid, A. Fawcett, F. Manis, & L.Siegel (Eds.), *The Sage Handbook of Dyslexia* (pp. 241-267). London: Sage.

Wadlington, E. M., & Wadlington, P. L. (2005). What educators really believe about dyslexia. *Reading Improvement, 42*, 16-33.

Wagner, R. F. (1973) Rudolf Berlin: Originator of the term dyslexia. *Annals of Dyslexia, 23*, 57-63.

Washburn, E. K., Joshi, R. M., & Cantrell, E. B. (2011a). Are preservice teachers prepared to teach struggling readers? *Annals of Dyslexia, 61*, 21-43.

Washburn, E. K., Joshi, R., & Binks-Cantrell, E. S. (2011b). Teacher knowledge of basic language concepts and dyslexia. *Dyslexia, 17*, 165-183.

Williams, J. A., & Lynch, S. A. (2010). Dyslexia: What teachers need to know. *Kappa Delta Pi Record, 46*, 66-70.

Vellutino, F. R., Fletcher, J. M., Snowling, M. J., & Scanlon, D. M. (2004). Specific reading disability (dyslexia): What have we learned in the past four decades? *Journal of Child Psychology and Psychiatry, 45*, 2-40.

Youman, M., & Mather, N. (2013). Dyslexia laws in the USA. *Annals of Dyslexia, 63*, 133-153. doi: 10.1007/s11881-012-0076-2