AN INVESTIGATION INTO ORTHOGRAPHIC PROCESSING DEFICITS IN SCHOOLS

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ABSTRACT

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One of the most significant educational milestones in a child's development is learning how to read and write. Phonological and orthographic processing skills are essential in the development of reading and writing. Currently, research exists that provides insight into school psychologists' knowledge of phonological processing's impact on reading and writing development and how deficits in this area are evaluated. However, very little is known about the overall level of familiarity school psychologists have with the construct of orthographic processing and how deficits are evaluated at the school level. The following study investigated the knowledge school psychologists have regarding orthographic processing. This study examined 197 school psychologists practicing throughout the United States on their training, assessment practices, and their overall knowledge of the concept of orthographic processing. Exploratory analyses highlighted that while School Psychologists are familiar with the construct of orthographic processing, their level of knowledge and confidence with identifying deficits in students is restricted due to many variables that involve lack of training and resources. Implications for graduate training programs, school districts, and continuing education programs are discussed.

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CHAPTER I: Introduction

Statement of the Problem

School psychologists are integral members of a multi-disciplinary team of professionals who provide support for both students and teachers through assessment, intervention, and consultation services. One of the main roles of a school psychologist is to identify and evaluate students who may require special education services (NASP, 2011). According to the International Dyslexia Association, approximately 85% of students who are referred for an evaluation to a school psychologist are referred due to literacy problems (Joseph, Wargelin, & Ayoub, 2016). Due to the number of children who are falling behind in reading and writing, school psychologists are likely spending a good portion of their time assessing students with literacy and writing problems. As of 2019, between 24 and 49 percent of fourth graders were performing at or above a proficient reading level, suggesting that the rest (approximately 51-76%) are falling behind (National Center of Educational Statistics, 2019).

Phonological and orthographic awareness are equally important for students' reading and writing development. Orthographic processing has been discovered through research to be an independent process from phonological processing, specifically when it comes to word recognition (Rothe et al., 2015). Between 2nd and 4th grade, as typically developing children begin to achieve fluent reading skills, student's reading begins to transform from serial letter-by-letter processing to a more parallel form of processing in which students start to rely more on their ability to form, store, and access orthographic representations (Boros et al., 2016).

Due to the gap in research on school psychologists' familiarly and knowledge of orthographic processing, it is assumed that deficits in this area are being overlooked. When learning deficits are overlooked, more times than not, students are left with an incorrect identification, ultimately leading to insufficient interventions and little to no support at school. In these cases, students are unfortunately set up to fail. School psychologists play a crucial role in correctly identifying learning disorders and providing appropriate recommendations for intervention. Nonetheless, if school psychologists are not provided with extensive knowledge or resources in specific areas, such as orthographic processing, they are often left with more questions than answers. The current study examined school psychologists' knowledge of orthographic processing and the barriers faced when identifying deficits among students to clarify best practices that may qualify as a standard for the future.

CHAPTER II: Literature Review

Orthographic Processing

According to Deacon (2019), orthographic processing is defined as the "ability to form, store, and access orthographic representations" (p. 510). As stated throughout the literature, in addition to phonological decoding, orthographic processing skills help with reading development and the ability to learn, read, and spell words (Deacon et al., 2019). Orthographic processing has been discovered through research to be an independent process from phonological processing skills, specifically when it comes to word recognition. Thus, deficits in orthographic processing skills can impact both reading and spelling in a distinct manner (Rothe et al., 2015). For instance, children with orthographic processing difficulties tend to rely more on phonological decoding when reading and writing due to their weak orthographic imagery which allows students to read and write irregular words (Rothe et al., 2015). Irregular words are defined as words that are spelled in an unusual or uncommon way that don't align with the rules of phonics (Wang et al., 2013). When reading irregular words, individuals draw upon orthographic images that are stored in their long-term memory. Those with orthographic processing weaknesses struggle to accurately recall these orthographic images which can lead to difficulty with recognizing numbers and letters and ultimately leads to serious problems with recalling how words look (Commodari et al., 2020).

Within the English language, approximately fifty percent of words are deemed irregular as they cannot be decoded through sound-symbol correspondence. Thus, orthographic functioning, or the ability to use orthographic processing skills, plays a particularly important role in reading and writing in English (Mesman and Kibby, 2011).

When it comes orthographic functioning, Mesman and Kibby (2011) discovered that linguistic and visual abilities are both contributing factors. Specifically, rapid naming, exposure to print, and visual processing can all impact a student's ability to use orthographic processing skills when it comes to word recognition (Mesman and Kibby, 2011).

English is regarded as a morphophonemic language which means that learning how to read and spell words is highly dependent on learning the interrelationships among phonological, orthographic, and morphological properties of words. English learners must understand the phonological codes in spoken words, orthographic codes in written words, and morphological codes in spoken and written words (Berninger et al., 2013). Additionally, compared to languages with a similar script and alphabet, such as Spanish and Italian where the relationships between phonemes and graphemes are constant, the English language has many alterations when it comes to grapheme-phoneme correspondence. Thus, languages like English with less transparent orthographies requires readers to learn and memorize the uncommon or arbitrary pronunciations of irregular words (Berninger et al., 2013).

After learning the alphabet, early readers learn to map graphemes (orthographic information) onto corresponding phonemes (phonological information) to sound out words. However, this skill alone does not lead to the most efficient reading abilities. Early readers must then learn to use orthographic information to retrieve semantic information to understand the meaning behind what is being read (Grainger & Hannagan, 2014). When it comes to orthographic information, its processing can be broken up into two different categories: orthographic learning and orthographic knowledge.

Orthographic learning is the child's ability to form orthographic representations (Deacon et al., 2019). Orthographic learning is described in the literature as the transition from the sounding out of unfamiliar words to being able to identify the same word rapidly and automatically. During the beginning stages of reading, orthographic learning is needed in order to become a proficient reader (Wang et al., 2014).

In contrast, orthographic knowledge is a child's store of orthographic representations (Deacon et al., 2019). According to Apel (2011), "orthographic knowledge represents the information that is stored in memory that tells us how to represent spoken language in written form; it is knowledge for the correct way to write language" (p. 592). In a literal sense, orthography means correct writing (orthos [correct], graphein [to write]). Orthographic knowledge plays an important role in literacy acquisition and contributes to the development of both reading and spelling skills (Apel, 2011). Orthographic knowledge is comprised of two components that allow individuals to read and write correctly: Mental Graphemic Representations (MGRs) and Orthographic Rules (Apel, 2011). MGRs are stored mental representations of specific written words or word parts, or simply put, memories for words. On the other hand, Orthographic Rules are rules that govern how speech must be represented in writing. These rules include how letters represent speech sound, what letters can and cannot be combined, and positional and contextual constraint rules for the use of letters (Apel, 2011). While these two components are different from one another, together they help individuals read and spell words (Apel, 2011). MGRs are acquired in both implicit and explicit ways and are developed in both the early and later stages of reading development (Apel, 2011). Some researchers believe that one component of orthographic knowledge

leads to the development of another. However, it is also suggested that children who develop early MGRs and an understanding of orthographic patterns at the same time may have a more general ability to acquire orthographic knowledge as a whole (Apel, 2011). Thus, a child who possess an extensive amount of orthographic knowledge may have more efficient reading acquisition abilities which can also help with learning new information that can then be incorporated into their lexicon (Deacon et al., 2019). According to a study by Wang and colleagues (2014), orthographic knowledge significantly predicts orthographic learning. That being said, both orthographic knowledge and orthographic learning are important components when acquiring the orthographic information necessary for reading and writing.

Dyslexia

Developmental dyslexia is defined in the literature as a reading disorder among individuals who never attained the ability to read. That is, individuals with developmental dyslexia have never had brain damage or lost the ability to read. In contrast, acquired dyslexia is defined as a reading disorder that is produced by some form of brain damage (Friedmann & Coltheart, 2018; Castles and Coltheart, 1993). Congenital word blindness was the term first used to describe developmental dyslexia and was treated as a singular syndrome with one underlying cause (Castles and Coltheart, 1993). However, research has shown that to be a skilled reader students use two different procedures when reading: a lexical procedure and a sub-lexical procedure (Grainger & Hannagan, 2014; Castles and Coltheart, 1993). This is commonly referred to as the dual route model of reading and provides evidence for the two different types of developmental dyslexia: phonological and surface dyslexia (Friedmann & Coltheart, 2018) The lexical procedure of the dual

route model involves the reader retrieving words from their mental lexicon and can be classified as the visual path to reading. (Grainger & Hannagan, 2014; Castles and Coltheart, 1993). When there are deficits in the lexical route, individuals struggle to read irregular words (i.e., colonel) and instead over-rely on their phonological skills and attempt to sound words out. On the other hand, the sub-lexical route utilizes grapheme-phoneme conversion and is considered the auditory path to reading (Grainger & Hannagan, 2014; Castles and Coltheart, 1993). When there are deficits in the sub-lexical route, individuals have a difficult time reading regular and unfamiliar words as they struggle to sound letters out. Thus, current, and previous research has provided evidence that there is a clear dissociation between surface dyslexia and phonological dyslexia as some readers display difficulty reading via lexical/visual procedures, while others struggle with sub-lexical/auditory procedures (Friedmann & Coltheart, 2018; Grainger & Hannagan, 2014; Castles and Coltheart, 1993).

As previously summarized, individuals with surface dyslexia are forced to rely on grapheme to phoneme conversation for oral reading due to deficits in their lexical route and thus, show orthographic processing deficits (Friedmann and Coltheart, 2018). Individuals with surface dyslexia that only impacts the lexical route of reading are able to read nonwords normally due to an intact sublexical route; however, they struggled with irregular and unpredictable words (Friedmann and Coltheart, 2018). Some common errors individuals with surface dyslexia make are regularization errors when reading aloud irregular words that include a silent letter (i.e., comb). Additionally, reading may be impacted with words that have "ambi-phonic graphemes" that allow for ambiguous conversions to phonology. For example, the letter *i* is pronounced one way in *kid* and

another way in *kind* (Friedmann and Coltheart, 2018). Other indicators of surface dyslexia in children may be difficulty reading sight words, spelling words as they sound rather than how they look, guessing on simple words (i.e., *it* or *on*), reversing letters, reversing the order of letters (i.e., *from vs. form*), sounding out every word including sight words, unwillingness to read aloud due to poor reading fluency, and underdeveloped writing due to few words in visual memory (Friedmann and Coltheart, 2018). Some signs of orthographic processing deficits in writing are reversals and transpositions of letters, different spellings for the same word, over-reliance on phonological rather than visual features of words including writing words the way they sound, omission of word endings, and an overall disorganization within their writing (no punctuation, no spaces, all upper-case words, or all lower-case words) (Chung & Patel, 2015).

Friedmann and Coltheart (2018) identified three subtypes of surface dyslexia and described how performance on various reading and spelling tasks are impacted by impairments at different loci on the lexical route. The first subtype of surface dyslexia is referred to as *input surface dyslexia* and leads to poor performance on lexical decision tasks, as well as homophone comprehension due to a deficit with the orthographic input lexicon (Friedmann and Coltheart, 2018). Additionally, deficits with the orthographic input can lead to difficulty with letter-recognition, letter transpositions, as well as letter reversals. This ultimately can lead to difficulty with determining if a letter string is a word or a nonword which significantly impacts a reader's ability to comprehend text (Feifer, 2018). The second subtype of surface dyslexia allows individuals to perform well on lexical decision tasks but results in impairment regarding the comprehension of

homophones. This is referred to as *orthographic lexicon output surface dyslexia* and essentially means that the orthographic input lexicon is accessible; however, it's output to the phonological output lexicon and to the semantic system is impaired (Friedmann and Coltheart, 2018). According to Feifer (2018), students with this subtype of surface dyslexia often show deficits in their oral reading skills as they struggle to match orthography to a phonological lexicon when reading aloud. Lastly, *interalexial surface dyslexia* allows for normal performance in both lexical decision and comprehension tasks as there is only a selective deficit in the connection between the orthographic input lexicon and the phonological output lexicon, with intact access from the orthographic input lexicon to the semantic system. Deficits in the connection between the orthographic input lexicon and phonological output lexicon lead to difficulties with reading aloud (Friedmann and Coltheart, 2018).

Visual Imagery and Orthographic Processing

During the early stages of reading acquisition, children begin to store aspects of word spelling in their memory. This allows their orthographic memory representations to become more accurate as they gain more reading experience (Holmes et al., 2008). Thus, children who don't present with reading difficulties are able to use their orthographic memory representations to identify words automatically and rapidly during reading (Holmes et al., 2008). When it comes to the role of visual memory in dyslexia, differing opinions exist. Brooks and colleagues (2011) suggest that impairments in visual working memory are common in dyslexia specifically when it comes to letter reversals during rapid automatic letter naming or rapid automatic letter writing tasks. On the other hand, Burt (2006) claims that visual memory does not play a role in reading acquisition as poor

readers do not show severe deficits on visual memory tasks. Additionally, Holmes and colleagues (2008) looked at the connection between inferior visual sequential memory in poor spellers and discovered no relationship. Instead, they suggest that the difficulties poor spellers have with remembering word specific orthographic information is related to an underlying orthographic processing problem and not a visual memory problem (Holmes et al., 2008).

More recently, Commodari and colleagues (2020) suggested that visual coding is an important component of reading skills as it contributes to the associations between spoken words and their written counterparts leading to the facilitation of word recognition. In particular, visual coding is a critical aspect of orthographic awareness, but is a complex skill that involves many other cognitive processes such as visual analysis and mental imagery (Commodari et al., 2020). Visual analysis allows an individual to attend to visual detail and visual patterns whereas mental imagery leads to the generation, inspection, and manipulation of mental images (Commodari et al., 2020). Therefore, reading in the English language requires a child to analyze and recognize specific attributes of visual stimuli which subsequently leads to the creation and reactivation of mental images of letters and words (Commodari et al., 2020).

To further support the notion that visual memory plays a role in orthographic processing, Vidyasagar and Pammer (2010) suggested that fast and effortless reading is associated with a region in the ventral visual stream called the Visual Word Form Area (VWFA). Researchers have reported that this area specializes in the recognition of letter strings and has been shown through neuroimaging studies to be under-activated in individuals with dyslexia (Vidyasagar and Pammer, 2010). In addition, through

neuroimaging, Boros and colleagues (2016) discovered another area in which dyslexic children showed under activation; the middle occipital gyrus (MOG) in the dorsal stream. Past research on the MOG has shown that this region assists in visuospatial processing and is important when ordering symbols in unfamiliar letter strings (Boros et al., 2016). Thus, it is suggested that during reading acquisition when the MOG processes information efficiently, it then allows for the development of fast and effortless visual word recognition in the VWFA (Boros et al., 2016). Overall, deficits in the MOG happen earlier in development and may result in later deficits in the VWFA which can have an impact on an individual's ability to shift from serial letter-by-letter decoding to parallel whole word reading (Boros et al., 2016). According to Feifer (2018), the left angular gyrus is another important brain region that is involved with orthographic assembly and word form. The left angular gyrus involves processes related to language, spatial cognition, and memory (Seghier, 2013). This brain region is sensitive to visual word form and thus, leads to difficulties with automatic letter or word recognition skills and overall reading fluency skills (Feifer, 2018). All in all, deficits in these brain areas may potentially result in the orthographic processing deficits that are seen in children with reading and writing difficulties and furthermore highlight the importance of visual memory skills in recognizing words.

Impact on School Performance

When it comes to literacy learning during the early school years (1st to 6th grade), three types of linguistic awareness exist that students develop to help with successful reading and writing; phonological awareness, orthographic awareness, and morphological awareness (Berninger et al., 2010). Phonological awareness is the ability one has to

recognize and manipulate the spoken parts of sentences and words. Orthographic awareness refers to the letter positions, combinations and sequences that make a word, while morphological awareness is an understanding of how words can be broken down into smaller units (Berninger et al., 2010).

Unfortunately, most primary grade teachers focus heavily on the development of phonological awareness and neglect orthographic and morphological awareness. While phonological awareness is an important aspect of learning to read and write in English, a study by Berninger and colleagues (2010) suggests that all three types of linguistic awareness are necessary for literacy learning. Thus, on top of providing more knowledge to teachers regarding the importance of all three types of linguistic awareness, reading and writing instruction in the early school years should focus on phonological, orthographic, and morphological awareness.

While reading difficulties are always on educators' and parents' radar, spelling difficulties, which become more pronounced during the later elementary school years, are often overlooked but are a persisting problem that can be related to dyslexia (and dysgraphia) across the lifespan. According to Berninger and colleagues (2013), parents have reported that when their dyslexic child makes improvements regarding their reading skills, it is difficult to convince schools to provide services for spelling and writing. Berninger and colleagues (2013) hypothesized that this could be a result of a lack of knowledge within the school systems about effective specialized writing instruction for children with dyslexia. As for writing instruction for children with dyslexia, orthographic training has been shown to outperform treatment that doesn't include any orthographic properties when it comes to a student's ability to spell real words (Berninger et al., 2013).

In typically developing children, many educators believe that there is a close relationship between reading and spelling skills (Hepner, McCloskey, & Rapp, 2017). Additionally, dysgraphia, a learning disorder that mainly affects writing, is frequently found to co-occur with developmental dyslexia. A recent study by Hepner, McCloskey, and Rapp (2017) suggests that there may be underlying difficulty that specifically affects the learning of orthographic word representations for spelling. Within their study, Hepner and colleagues (2017) looked at the relationship between reading and spelling in two children with developmental dysgraphia. One child was found to show impaired orthographic long-term memory processing in spelling and superior orthographic long-term memory processes in reading. Results from their study lead them to conclude that at least some components of lexical orthographic representation and processing develop independently in spelling and reading (Hepner, McCloskey, & Rapp, 2017). Consequently, orthographic deficits in reading may not always co-occur with orthographic deficits in writing and vice versa; however, it is important to evaluate both as a way to understand where these deficits are impacting a child most academically.

Orthographic Processing Measures

As a form of measuring orthographic processing skills, researchers have commonly used measures such as an orthographic choice tasks, homophone choice tasks, and orthographic awareness tasks (Deacon et al., 2019; Cunningham & Stanovich, 1990; Siegel et al., 1995). In orthographic choice tasks, participants view a pair of letter strings that sound alike (e.g., rume-room, lurn-learn) and indicate which letter string was spelled correctly (Cunningham & Stanovich, 1990). On a homophone choice tasks, participants are read a question orally by the examiner (e.g., “Which is a fruit?”) and then presented

with two homophones side by side to choose from (e.g., pair-pear) (Cunningham & Stanovich, 1990). On the other hand, orthographic awareness tasks relate to orthographic rules and ask the participants which words are legal in English (e.g., folk-filv) (Siegel et al., 1995). Additionally, diagnostic reading tasks have been used as a way to detect differences in reading between regular, irregular, and pseudowords, and tasks that look at embedded words within a string of letters (e.g., xklhbinpt) have also been used as a measurement of orthographic ability (Castles and Coltheart, 1993; Hultquist, 1997).

As for psychological assessments that measure orthographic ability, the Test of Silent Word Reading Fluency- Second Edition (TOSWRF-2) was developed as a reliable and valid measure of students' ability to recognize printed words accurately and efficiently (Mather et al., 2014). Throughout this assessment, individuals are asked to draw a line between as many words as they can under a time limit. The Test of Orthographic Competence (TOC) is also used to assess orthographic processing skills and is composed of nine subtests that assess aspects (letters, spelling, punctuation, abbreviations, and special symbols) of the English writing system that are necessary for proficient reading and writing (Mather et al., 2008). Additionally, the Test of Irregular Word Reading Efficiency (TIWRE) is another assessment the measure's orthographic ability by asking individuals to read irregular words in a list format while being timed (Reynolds and Kamphaus, 2007). Lastly, in Fall 2020 the Wechsler Individual Achievement Test Fourth Edition (WIAT-4) was published and included new subtests that looked at orthographic fluency and orthographic choice (Breaux, 2020). The orthographic choice subtest measures an examinees orthographic knowledge by providing examinees with three choices of letter strings and asks them to identify the

letter string identified correctly (Breaux, 2020). The orthographic fluency subtest specifically measures an examinees orthographic lexicon, in other words their sight word vocabular, by having them read aloud a list of irregular words during timed trials (Breaux, 2020). Nonetheless, while few assessments do exist to measure orthographic processing in children, it is not known if school psychologists are using them accordingly.

The Role of School Psychologists

School psychologists are integral members of a multi-disciplinary team of professionals provide support for both students and teachers through assessment, intervention, and consultation services. One of the main roles of a school psychologist is to identify and evaluate students who may require special education services (NASP, 2011). Under the Individuals with Disabilities Education Act (IDEA), 7.3 million students from the ages of 3-21 received special education services in the 2019-2020 school year (Irwin et al., 2021). Of the 7.3 million, 33 percent of students were classified with specific learning disabilities, more prevalent than any other IDEA 2004 classification (Irwin et al., 2021). The federal definition of a specific learning disability is as follows:

> "A disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, which manifests itself in the imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such terms include such conditions as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia…" (IDEA 2004, §602.30, Definitions).

The educational system plays a vital role in the diagnosis and treatment of specific learning disorders (Chung, Patel, and Nizami, 2020). Children who are classified under the specific learning disability (SLD) classification, including students with dyslexia, often receive an Individualized Education Plan (IEP) to ensure that they receive specialized instruction and related services for their disability (NASP, 2011). To provide a student with an IEP classification of SLD, a school psychologists must first rule out any exclusionary criteria (i.e., attendance, vision or hearing problems, etc.) followed by classroom-based interventions related to their academic difficulties that fit within a multi-tiered system of support (MTSS) (NASP, 2011). If classroom-based interventions are not shown to be effective, school psychologists then consider an educational disability and conduct a psychological assessment to determine the cognitive factors that may be impacting learning, social/emotional, and mental performance (NASP, 2011). After an evaluation is complete, school psychologists use the results from the evaluation along with other data from teachers and parents to determine if a student is eligible for special education services (NASP, 2011).

To receive a classification of SLD, school psychologists typically follow one of three methods delineated by the regulations that the accompany IDEA 2004, to identify or rule out SLD and to determine appropriate services, if needed. The three methods used to determine if a student is eligible for a SLD classification are the Discrepancy Model, Response to Intervention (RTI) Model, and Pattern of Strengths and Weaknesses (PSW) Model (Alfonso & Flanagan, 2018). The Discrepancy Model compares cognitive assessment scores to academic assessment scores, the RTI Model analyzes how well as student when provided with a scientifically based reading curriculum and interventions,

and the PSW Model identifies a processing deficit in a specific area of psychological functioning (Alfonso & Flanagan, 2018). However, depending on the model and measures used, some students with academic difficulties may not meet the criteria as a student with a specific learning disability. In turn, these students may not qualify for special education services and will continue to struggle academically without any answers regarding why they are struggling.

According to the International Dyslexia Association, approximately 85% of students who are referred for an evaluation to a school psychologist are referred due to literacy problems (Joseph, Wargelin, & Ayoub, 2016). As of 2019, between 24 and 49 percent of fourth graders were performing at or above a proficient reading level. suggesting that the rest (approximately 51-76%) are falling behind (National Center of Educational Statistics, 2019). Additionally, school psychologists have reported that they have seen a noticeable increase in the number of parents referring their children for an evaluation based on suspicions of dyslexia (Joseph, Wargelin, & Ayoub, 2016). As for writing difficulties, approximately 10 to 30 percent of students are currently experiencing problems with written expression (Chung, Patel, and Nizami, 2020). Due to the number of children who are clearly falling behind in reading and writing, school psychologists are likely spending a good portion of their time assessing students with literacy and writing problems. However, when it comes to being classified with a specific learning disability, some students with reading and writing difficulties might not be identified as students with a disability despite evident academic weaknesses. To date, it is unknown how many students who truly have an SLD are not found eligible or why they slip through the

cracks. Oftentimes, parents of these students seek private evaluations at very high costs to get a better understanding of why their child is struggling academically.

According to Kohnen in colleagues (2012), students whose parents and teachers reported concerns about their reading, specifically when it came to errors with confusing migratable words (i.e., reading *form* as *from* and *slime* as *smile)* were not shown by standardized test to have any deficits. However, when these children were examined using target words that related to their common reading errors, letter position dyslexia was detected (Kohnen et al., 2012). Thus, standardized assessments were unable to pick up on these difficulties even though they were reported by both parents and teachers; unfortunately, it is possible that this phenomenon might be happening more frequently than we'd like to admit.

Considering school psychologists and teachers tend to focus more on the development of phonological processing with regard to reading and writing, and information about orthographic processing is not popular, it is likely that these deficits might be overlooked by school psychologists when evaluating for SLD (Berninger et al., 2010). Furthermore, students with reading and writing difficulties who are not being identified as SLD may also be students with orthographic processing deficits. Due to the lack of school psychologists' knowledge surrounding orthographic processing, as well as the marginal number of assessments available to measure these deficits, they may very well be going unidentified. While a number of assessments are available to measure the phonological aspects of reading and writing difficulties, the majority of students with orthographic processing deficits will do well on these tasks due to an intact sublexical route. Additionally, research in the past has suggested that orthographic processing

difficulties may be better understood as a delay, as opposed to a genetically predetermined cognitive deficit that arises due to limitations in the environment, reading experience, and print exposure (Bailey et al., 2004; Manis et al., 1996). Thus, students with these deficits may not show any areas of cognitive weakness and moreover, will not receive a classification as learning disabled even with clear academic weaknesses.

CHAPTER III: Research Objectives

Currently, there is no documented insight into the knowledge school psychologists have regarding orthographic processing and how deficits in this area are evaluated. Phonological and orthographic awareness are equally important for students reading and writing development. Orthographic processing has been discovered through research to be an independent process from phonological processing skills, specifically when it comes to word recognition. Due to this gap in the literature, it is assumed that deficits in this area are being overlooked and may be leading to incorrect identification and insufficient interventions and related services at the school level. The purpose of this study was to explore the level of knowledge school psychologists have with regard to orthographic processing, as well as potential barriers faced in accessing knowledge and resources will allow for the gaps in this area of research to be filled and could help clarify best practices that may qualify as a standard for the future.

CHAPTER IV: Methods

Participants and Procedure

Approval from the authors' institutional review board (IRB) was obtained prior to the commencement of data collection. From September 2022 to January 2023, participants were recruited via online websites (i.e., Facebook, LinkedIn) and various listservs (i.e., NASP accredited school psychology program alumni listservs, state school psychology association member listservs) that targeted school psychologists, nationally. No identifying information was requested so it was not possible to estimate how many participants were obtained from each solicitation. To be included in this study, participants had to be practicing school psychologist for at least one year in a public or private school setting. Participants were excluded from this study in the case of being (1) a practicing school psychologist for less than a year, (2) a practicing school psychologist in specialized schools that do not include working with children with specific learning disabilities.

Participants received a brief description of the study, as well as a link to a Qualtrics survey. After following the link to the Qualtrics survey, participants read information about the study and were provided with a consent form, which informed participants that their responses would remain completely anonymous and that they could opt-out of the survey at any time. Those who provided consent then continued on to the study, while those who did not provide consent were exited from the system. The survey was open from September 10, 2022, to February 7, 2023. Overall, 232 participants attempted the survey, but only 197 (85%) successfully completed it. Of those 197 participants, 146 (74%) participants completed the survey all the way through. The other

51 (26%) participants completed the majority of the survey; however, stopped when asked to describe orthographic processing in detail. Further analysis did not reveal insight into patterns of participants who stopped at this point. Considering the primary objective of this study was to explore participants' knowledge of orthographic processing, all 197 participants were used for the data analyses to analyze the differences between those with and without knowledge of this topic.

Measures

Data were collected via an online survey that was created and launched via Qualtrics. The survey consisted of 47 multiple choice, yes/no, and open-ended questions. The total number of questions that each participant responded to varied depending on how they responded to questions throughout the survey. The survey was designed to gather information from the sample regarding their demographic and personal background, credentials, training, and their knowledge of the concept of orthographic processing. The first part of the survey on Qualtrics consisted of demographic questions about gender, ethnicity, and educational and employment background. Following demographic questions, participants answered questions regarding the cognitive and achievement assessment methods they use, along with questions regarding the concept of orthographic processing and how deficits in this area manifest in reading and writing. After completion of the survey, participants submitted their responses which were then recorded on Qualtrics.

After participants completed the questionnaire via Qualtrics, their responses were transferred to an IBM SPSS Statistics program where the data were analyzed. All data

were analyzed using exploratory statistical procedures from IBM SPSS Statistics (Version 28).

CHAPTER V: Results

Demographics

One hundred ninety-seven (N= 197) school psychologists participated in this study. The sample included 14 males, 176 females, and 2 non-binary/third gender individuals. With regard to ethnicity, 174 participants identified as Caucasian, 16 as Hispanic or Latino, 6 identified as Black or African American, and 2 identified as Asian. One hundred ninety participants were employed at the time of the study, while 5 participants were unemployed. One hundred fifty-seven participants reported their primary job title as School Psychologist, 9 reported Bilingual School Psychologist, 20 reported Psychologist, and 2 reported Chairperson, Committee on Special Education. Sixty-one participants reported that their highest degree earned was at the Doctoral Level, 25 participants at the Master's Level, and 111 respondents reported they are at the Specialist Level. Table 1 represents the demographic data collected on the school psychologists.

Compared to the 2020 NASP membership report, the demographic characteristics of this sample are consistent with regard to gender, race, and highest level of degree (Goforth et al., 2021): gender, Female (M = 869), Male (M = 118), Non-Binary (M = 1); race, American Indian or Alaskan Native (M = 7), Asian (M = 24), White (M = 85), Native Hawaiian or Other Pacific Islander (M = 1); highest level of degree, Master's Level Only (M = 93), Specialists Level (M = 736), Doctoral Level (M = 164). One exception was the mean years of experience (M = 13.5 years) the NASP 2020 sample had compared to the current sample, in which the majority was comprised of more

practitioners who had anywhere from 1 to 10 years of experience. See Table 1 for a summary of basic demographic characteristics.

Table 1

Demographic Characteristics of Participants

Characteristics	*N*	*%*
Gender		
Female	176	89.3
Male	14	7.1
Missing	4	2.0
Non-Binary/Third Gender	2	1.0
Prefer Not To Say	1	0.5
Ethnicity		
Caucasian	174	86.6
Hispanic/Latino	16	8.0
Black/African American	6	3.0
Prefer Not to Answer	2	1.5
Asian	2	1.0
Primary Job Title		
School Psychologist	157	79.7
Psychologist	20	10.2
Bilingual School Psychologist	9	4.6
No Response	6	3.0
Other	3	1.5
Chairperson, Committee on Special Education	2	1.0
Highest Degree Earned		
Specialist Degree (60+ credit degree)	111	56.3
Doctoral Degree	61	31
Masters Degree (30 credit degree)	25	12.7
Type of Degree Earned		
Master of Arts	44	22.3
Doctor of Philosophy	28	14.2
Master of Science	26	13.2
Doctor of Psychology	26	13.2
Educational Specialist	20	10.2
Master of Education	19	9.6
No Response	16	8.1
Certificate of Advanced Graduate Studies	8	4.1
Other	6	3.0
Doctor of Education	3	1.5
Degree Subject Area		
School Psychology	152	77.2
Other	15	7.6
Educational Psychology	10	5.1
Psychology	6	3.0
Clinical Psychology	5	2.5
Combined School and Clinical Psychology	3	1.5
Counseling Psychology	2	1.0
Curriculum and Instruction	2	1.0
Social Psychology	1	0.5
No Response	1	0.5
State Practiced School Psychology		

New York	65	33.0
California	30	15.2
Massachusetts	11	5.6
Arkansas	10	5.1
North Carolina	9	4.6
Illinois	8	4.1
Michigan	8	4.1
Colorado	6	3.0
New Jersey	6	3.0
South Carolina	6	3.0
Georgia	5	2.5
Pennsylvania	5	2.5
Rhode Island	5	2.5
Texas	5	2.5
Arizona	3	1.5
Florida	2	1.5
New Hampshire	3	1.5
Tennessee	3	1.5
Virginia	3	1.5
Washington	3	1.5
Indiana	2	1.0
Iowa	2	1.0
Maine	2	1.0
Maryland	2	1.0
Ohio	2	1.0
Vermont	2	1.0
No Response	2	1.0
Alabama	2	1.0
Connecticut	2	1.0
Kentucky	1	0.5
Minnesota	1	0.5
Nebraska	1	0.5
New Mexico	1	0.5
Oregon	1	0.5
West Virginia	1	0.5
Wyoming	1	0.5
Currently Employed		
Yes	190	96.4
No	5	2.5
Prefer Not to Respond	2	1.0
Reason for Unemployment		
Currently a Student	3	1.5
Retired	1	0.5
Maternity Leave	1	0.5
Employment Setting		
Public School	165	76.7
Private Practice	31	14.4
University/College	8	3.7
Hospital	3	1.4
Private Non-Sectarian School	2	0.9
Private Sectarian School	1	0.5
University/College Psychological Services Center	1	0.5
Grades/Ages Worked With		
Elementary Grades (K-4)	145	25.0
Middle School (5-8)	130	22.4
Primary Grades (K-2)	109	18.8

High School (9-12)	93	16.0
Preschool (Ages 3 to 5)	71	12.2
College (13+)	24	4.3
Early Intervention (Ages 0 to 2)	8	1.4
Number of Years Employed in Field		
1 – 4 years	58	29.4
5 – 10 years	55	27.9
11 – 14 years	31	15.7
15 – 20 years	26	13.2
21 – 25 years	9	4.6
26 – 30 years	7	3.6
30 + years	4	2.0
No Response	5	2.5
Socioeconomic Status of School District		
Low SES	66	33.5
Middle SES	86	43.7
Upper Middle SES	33	16.8
High SES	10	5.1
No Response	2	1.0
Credentials Possessed Currently		
Certification	140	56.9
Licensed School Psychologist	66	26.8
Licensed Psychologist	40	16.3
Credentials Needed to Practice in State		
Certification granted by State DOE	173	87.8
License granted by a Psychology Board	9	4.6
Licensed granted by a Local Educational Agency	8	4.1
I Don't Know	4	2.0
No Response	2	1.0
Continuing Education Credits to Maintain Credentials		
Yes	135	68.5
No	53	26.9
I Don't Know	9	4.6

Note. $n = 197$

Assessment Practices of School Psychologists

Ninety-nine percent of practitioners conducted cognitive assessments in their current role. Sixty-eight percent of practitioners spent anywhere from 10 to 59 percent of their time administrating cognitive assessments. In contrast, only 66% of practitioners conducted academic achievement assessments in their current role. Of those who conducted achievement assessments, 65% spent anywhere from 20 to 59 percent of their time administering academic achievement assessments and 68% conducted 10 to 60 achievement assessments per year. Eighty-seven percent of practitioners reported that they conduct all the evaluations that are assigned to them. Of the 13% who didn't conduct

all the assessments assigned to them, another school psychologist (39%), special education teacher (26%), intern (22%), testing technician (9%), or external psychologist (4%) conducted the assessments instead.

Sixty-eight percent of the practitioner's assessment methods adhere to a theoretical framework. The most common theoretical frameworks that the sample followed are Cattel-Horn-Carroll Theory of Human Cognitive Abilities (CHC Theory) (76%) and Neuropsychological Theory (16%). With regard to determining what assessment measures to use, 26% of practitioners based it on the referral question, 20% based it on client characteristics, 16% based it on the hypotheses they have generated about the nature of the problem, 14% based it on the psychometric properties of the test, 10% on the tests they are the most comfortable with, 7% based it on the theory they prescribe to, and 7% indicated that their employment setting dictates the tests they can use. When it comes practitioners' choice of core cognitive battery when evaluating students suspected of having a specific learning disability, 66% indicated that they use the Wechsler Intelligence Scales for Children – Fifth Edition (WISC-V). Additionally, 9% preferred to use the Kaufman Assessment Battery of Children, Second Edition Normative Update (KABC-II NU), 8% preferred to use the Woodcock-Johnson Tests of Cognitive Abilities – Fourth Edition (WJ IV COG), and 9% indicated that they do not use cognitive tests to identify specific learning disabilities. As for practitioners' preference when it comes to measures of achievement for students suspected of having a specific learning disabilities, the most popular measures amongst the sample were the Kaufman Test of Education Achievement – Third Edition (KTEA-3) (21%), the Wechsler

Individual Achievement Test – Fourth Edition (WIAT-4) (21%), and the Woodcock-Johnson Tests of Achievement – Fourth Edition, (WJ IV ACH) (15%).

Knowledge and Familiarity with Orthographic Processing

More than half (54%) of practitioners indicated that they were "Familiar" with the construct of orthographic processing, while 11% indicated that they were "Very Familiar" with the construct. In contrast, 28% of practitioners reported that they were "Slightly Familiar" and 6% indicated that they were "Not Familiar" with the construct at all. Of the participants who indicated that they were at least "slightly familiar" with the construct, when asked to describe in their own words what orthographic processing is and how it relates to academic performance, the most common responses indicated that orthographic processing impacts the recognition and recall of words (22%), impacts both reading and spelling (21%), and involves the ability to form, store, and access orthographic representations (21%). Thirteen percent of practitioners indicated that it involves knowledge and understanding of visual symbols as letters and words, 5% reported that orthographic processing plays a role in a student's ability to read and spell irregular and sight words, 5% indicated that it draws upon orthographic images that are stored in long-term memory, and 2% indicated that it is the mapping of sounds and letters to make words. Only 2% of practitioners indicated that it has an impact on mathematics, specifically mathematical problem solving, while 2% of the sample indicated that orthographic processing involves a visual processing deficit. On the other hand, 17% of the sample indicated that orthographic processing only impacts writing and spelling, 5% reported that the construct impacts decoding only, while 8% described aspects phonological processing when describing orthographic processing (e.g., ability to

understand and apply sound patterns when decoding, the ability to coordinate sounds and sound pairings with letters and blend letter sounds together).

Table 2

How familiar are you with the construct of orthographic processing?

	N	*%*
Not Familiar	11	5.6
Slightly Familiar	56	28.6
Familiar	107	54.6
Very Familiar	22	11.2

Note. n = 196

When asked to describe to the best of their knowledge how weaknesses in orthographic processing manifest in reading, 52% of practitioners indicated its impact on reading fluency. Other common responses included an impact on the decoding of irregular and sight words (36%), difficulties with word identification and recognition (28%), and overall poor reading comprehension (22%). Additionally, practitioners indicated that deficits in orthographic processing can lead to difficulties with distinguishing visually similar letters when reading (9%) and an over-reliance on decoding and sounding out words (7%). Eight percent of practitioners gave examples of how phonological processing deficits manifest in reading (e.g., trouble with identifying letter sounds and blending letters together to read words, struggle with sound-symbol association and nonsense word decoding).

When asked to describe to the best of their knowledge how weaknesses in orthographic processing manifest in writing, 63% of practitioners indicated that deficits lead to poor spelling. Other common responses included an impact on written expression (20%), difficulties with sentence structure (18%), and poor letter formation (14%). Additionally, practitioners indicated that deficits in orthographic processing can lead to difficulties with spelling irregular words (10%) and writing fluency (10%). Three percent

of practitioners gave examples of how phonological processing deficits manifest in writing (e.g., difficulty recalling sound-letter patterns, trouble spelling words phonetically, not corresponding the correct letters with the sounds they are saying as they spell).

When asked if they had enough knowledge of orthographic processing to accurately identify deficits in students, 55% of practitioners indicated "Yes" while the other 45% indicated "No". Of the practitioners that indicated that they had enough knowledge to identify orthographic processing deficits in students (*n*= 86), 44% reported that they obtained their knowledge from their own research, 20% indicated they received their knowledge from their school psychology program, while 19% reported they received their knowledge from continuing education courses.

Table 3

Do you feel you have enough knowledge regarding orthographic processing to identify deficits in students?

	N	*%*
Yes	86	54.8
No	71	45.2

Note. n = 157

Table 4

Where did you obtain the most knowledge regarding orthographic processing in students?

	N	*%*
School Psychology Program	16	19.8
Continuing Education Course	15	18.5
Own Research	36	44.4
Other	14	17.3
Field Work/Work Experience	11	5.6
Neuropsychology Program	2	1.0

Note. n = 86

Sixty-five percent of practitioners felt that their knowledge regarding orthographic processing has assisted them in making the appropriate decisions when presented with a student with below grade level reading and writing; however, shows

average cognitive abilities. Forty-seven percent of practitioners indicated that their knowledge of orthographic processing in these situations assist in their ability to provide the appropriate interventions and recommendations for students with these characteristics. Seventeen percent indicated that their knowledge of orthographic processing helps them in identifying students with these characteristics as specific learning disabled, 12% indicated that their knowledge helps them with identifying specific skill deficits in reading and writing, 7% of participants reported that their knowledge provides them with more clarity on why a student may be struggling with reading and writing, and another 7% indicated that their knowledge forces them to dive deeper in their evaluations before coming to a conclusion (e.g., looking at work samples, more testing, etc.).

Table 5

Do you feel as though your knowledge regarding orthographic processing assists you in making appropriate decisions when presented with a student with below grade level reading and writing and average cognitive abilities?

	N	*%*
Yes	84	64.6
No	46	35.4

Note. n = 130

A MANOVA analysis was conducted to explore the differences among practitioners' familiarity and knowledge of orthographic processing. There was a significant difference between years employed when it came to familiarity with the construct, feeling as though one has enough knowledge to identify deficits in students, and overall feeling like their knowledge of the construct assists them in making appropriate decisions for students with these deficits ($F (18, 326) = 1.964$, $p = .011$, Wilk's $\Lambda = .747$, partial $\eta^2 = .093$). Tukey post hoc testing revealed that practitioners who

had been working in the field for 15 to 20 years (M = 3.2, SD = .68) had significantly more familiarity with the construct when compared to practitioners who have only been working in the field for 1 to 4 years (M = 2.3, SD - .68). On the contrary, practitioners who had been working in the field for 1 to 4 years (M = 1.6, SD =.48; M = 1.5, SD = .51) had felt as though their knowledge helped them to better identify and provide appropriate decisions for students with these difficulties when compared to practitioners working in the field for 15 to 20 years (M = 1.1, SD = .35; M = 1.1, SD = .26). Taken together, these results suggest that the number of years employed in the field has an effect on one's familiarity with orthographic processing and a practitioner's ability to identify deficits and use their knowledge to assist them in making appropriate decisions for students with these difficulties.

Furthermore, there was a non-significant difference between familiarity with the construct, feeling as though one has enough knowledge to identify deficits in students, and overall feeling like their knowledge of the construct assists them in making appropriate decisions for students with these deficits based on primary job title ($F(6, 232) = 1.806$, $p = .099$, Wilk's Λ = ..913, partial $\eta^2 = .045$) and on the number of achievement assessments conducted each year ($F(27, 240) = 1524$, $p = .052$, Wilk's $\Lambda = .630$, partial $\eta^2 = .143$).

However, there was a significant effect of primary job title and feeling as though one has enough knowledge to identify deficits in students ($F(2,120) = 3.860$, $p = .024$), as well as primary job title and feeling like their knowledge of the construct assists them in making appropriate decisions for students with deficits ($F(2,120) = 3.420$, $p = .036$). Tukey post hoc testing revealed that practitioners who use the primary job title of

"Bilingual School Psychologist" (M = 1.83, SD = .41; M = 1.7, SD = .52) felt as though their knowledge helped them to better identify and provide appropriate decisions for students with orthographic deficits compared to practitioners who use the primary job title of "Psychologist" (M = 1.17, SD = .39; M = 1.08, SD: .29). These results suggest that bilingual practitioners may feel more confident in their ability to identify and provide recommendations for students with orthographic processing deficits than those who only identify as a "Psychologist".

Lastly, there was a significant effect on the number of academic achievement measures administered each year and familiarity of the construct of orthographic processing ($F(9, 93) = 3.772$, $p < .001$). Tukey post hoc testing revealed that familiarity of the construct of orthographic processing was significantly lower in participants who conduct 1 to 9 achievement assessments per year (M = 1.67, SD = 0.82) compared to practitioners who administer 80 to 89 achievement assessments per year (M = 3.5, SD = 0.58), 50 to 59 achievement assessments per year (M = 2.86, SD = .53) 30 to 39 achievement assessments per year (M = 3.1, SD = 0.74), 20 to 29 achievement assessments per year (M = 2.92, SD = 0.79), and 10 to 19 achievement assessments per year (M = 2.92 , SD = .79). Taken together, these results suggest that the amount of academic achievement assessments conducted each year has an effect on one's familiarity with orthographic processing. Specifically, practitioners who conduct more academic achievement assessments per year have more familiarity with the construct compared to those who conduct less per year.

Accuracy Rate with Identifying Deficits

Eighteen percent of practitioners reported that they were able to successfully identify the cognitive processes that are related to the specific characteristics of orthographic processing only 1 to 9 percentage of the time. Fifteen percent indicated that they are able to identify the cognitive processes at least 50 to 59 percent of the time, while 4% indicated that they are able to identify these processes 100 percent of the time. When asked what cognitive processes are involved with orthographic processing, the most common cognitive processes reported by practitioners were visual-spatial processing (52%), working memory (29%), processing speed (26%), and long-term storage and retrieval (23%). 6% of the sample indicated that orthographic processing in itself is a cognitive process.

Table 6

What is the estimated percentage of time that you are able to successfully identify the cognitive processes that are related to specific characteristics of orthographic processing?

	N	*%*
100% of the time	6	4.3
90-99% of the time	10	7.1
80-89% of the time	12	8.5
70-79% of the time	15	10.6
60-69% of the time	10	7.1
50-59% of the time	21	14.9
40-49% of the time	3	2.1
30-39% of the time	13	9.2
20-29% of the time	14	9.9
10-19% of the time	11	7.8
1-9% of the time	26	18.4

Note. n = 141

A one-way between subjects analysis of variance was conducted to evaluate the relationship between the percentage of time a practitioner is able to successfully identify the cognitive processes related to characteristics of orthographic processing and if their assessment methods adhere to theoretical framework. There was a significant difference

between a practitioners assessment methods adhering to theoretical framework and the percentage of time they are able to successfully identify the cognitive processes related to characteristics of orthographic processing ($F(1,136) = 8.046$, $p < .001$), along with a significant difference between the theoretical framework which a practitioner adheres to ($F(2,90 = 3.427$, $p = 0.37$).

Tukey post hoc testing revealed the percentage of time a practitioner could successfully identify the cognitive processes related to orthographic processing was significantly higher in practitioners who adhered to a theoretical framework ($M = 6.03$, $SD = 3.20$) compared to those who don't adhere to a theoretical framework ($M = 7.88$, $SD = 2.74$) or those who did not know what the question was asking ($M = 8.87$, $SD = 2.29$). Further, the percentage of time a practitioner could successfully identify the cognitive processes related to orthographic processing was significantly higher in practitioners who adhered to Neuropsychological Theory ($M = 4.07$, $SD = 3.22$) compared to those who adhered to Cattell-Horn-Carroll Theory of Human Cognitive Abilities (CHC Theory) ($M = 6.29$, $SD = 3.09$). Taken together, these results suggest that whether or not a practitioners assessment methods adhere to theoretical framework has an effect on a practitioner's ability to successfully identify the cognitive processes related to orthographic processing. Specifically, those who adhere to Neuropsychological Theory are better able to identify the cognitive processes related to characteristics of orthographic processing than those who adhere to CHC Theory.

Measures of Orthographic Processing

When evaluating students who show reading and writing deficits, 68% of practitioners reported that they always include measures of orthographic processing. Of

these practitioners (n= 100), the most common assessments used to measure orthographic processing in students are the Wechsler Individual Achievement Test, Fourth Edition (WIAT-4): Spelling, Orthographic Fluency, Orthographic Choice Subtests (28%), Kaufman Test of Educational Achievement, Third Edition (KTEA-III): Spelling Subtest (23%), the Feifer Assessment of Reading (FAR): Orthographic Processing Subtest (16.1%), and the Woodcock-Johnson Tests of Achievement, Fourth Edition (WJ IV ACH): Spelling Subtest (15%). When asked what makes them decide to include measures of orthographic processing in an evaluation, 24% of practitioners reported that they include these measures on all of their evaluations no matter the referral concern, while 38% indicated that they include these measures on all of their reading and writing evaluations. Similarly, 18% reported that they include orthographic processing measures based on the referral concern, 13% based it on results from core assessment measures, 9% indicated that they include measures if they notice poor spelling, but good reading, and 6% reported that they use these measures if informal data (e.g., writing samples, classwork, observations) indicate a student's orthographic processing may be a concern. Fifty-five percent of practitioners found the current measures of orthographic processing to be comprehensive, while 44% did not. When asked why they did not find these measures to be comprehensive, 5% of practitioners indicated that there are not enough subtest or items that tap into orthographic processing. Furthermore, the sample indicated that these measures don't delineate the exact problem (3%), there are gaps and a lack of information when using these measures with regard to orthographic processing (3%), it's a difficult skill to assess (2%), informal methods are more useful than these measures (2%), and a lack of the evaluators knowledge in this area plays a role (2%).

Table 7

When evaluating students with reading and writing difficulties, do you include measures of orthographic processing?

	N	*%*
Yes	100	68.5
No	46	31.5

Note. n = 146

Table 8

Measures of orthographic processing that are used (select all that apply)

	N	*%*
Wechsler Individual Achievement Test, Fourth Edition (WIAT-4): Spelling, Orthographic Fluency, Orthographic Choice Subtests	65	28.3
Kaufman Test of Educational Achievement, Third Edition (KTEA-III): Spelling Subtest	53	23.0
Feifer Assessment of Reading (FAR): Orthographic Processing Subtest	37	16.1
Woodcock-Johnson Tests of Achievement, Fourth Edition (WJ IV ACH): Spelling Subtest	34	14.8
Test of Written Language, Fourth Edition (TOWL-4): Spelling Subtest	17	7.4
Test of Orthographic Competence (TOC)	11	4.8
Process Assessment of the Learner, Second Edition Reading and Writing (PAL-II RW): Orthographic Coding, Orthographic Spelling Subtests	6	2.6
Test of Silent Word Reading Fluency, Second Edition (TOSWRF-2)	4	1.7
Test of Irregular Word Reading Efficiency (TIWRE)	2	0.9
Bateria IV Woodcock-Munoz: Pruebas de aprovechamineto (Bateria 1V) Ortografia Subtests	1	0.4
Other		
WISC-V Associative Memory	2	1.0
NEPSY-II Associative Memory	1	0.5
TVPS Visual Sequential Memory	1	0.5
CTOPP-2	4	2.0
FAR Rapid Automatic Naming	1	0.5
FAR Visual Perception	1	0.5
Fiefer Assessment of Writing (FAW)	3	1.5
KTEA-3 Orthographic Composite	5	2.5
Test of Silent Contextual Reading Fluency-2	1	0.5
TOWRE	2	1.0
Informal Methods	2	1.0

Note. n = 197

Table 9

Do you find these measures of orthographic processing to be comprehensive?

	N	*%*
Yes	54	55.1
No	44	44.9

Note. n = 98

A MANOVA analysis was conducted to explore the differences among practitioner's use of orthographic processing measures and their beliefs on if these measures are comprehensive or not. There was a significant difference between years employed in the field and using measures of orthographic processing on assessments and finding them to be comprehensive ($F(12, 172) = 6.019$, $p < .001$, Wilk's $\Lambda = .496$, partial $\eta^2 = .336$). Specifically, there was a significant effect on number of years employed and including measures of orthographic processing ($F(6, 93) = 14.191$, $p < .001$). Tukey post hoc testing revealed that practitioners who had been working in the field for 30 or more years ($M = 1.5$, $SD = .71$) were significantly more likely to include measures of orthographic processing when compared to practitioners who had been in the field for less than 30 years ($M = 1.0$, $SD = .0$). Results suggest that those who have been employed in the field longer, are more likely to include measures of orthographic processing.

Furthermore, there was a non-significant difference between primary job title, using measures of orthographic processing on assessments, and finding them to be comprehensive ($F(4, 176) = 1.900$, $p = .112$, Wilk's $\Lambda = .919$, partial $\eta^2 = .041$). However, there was a significant effect of primary job title and including measures of orthographic processing on reading and writing assessments ($F(2, 91) = 3.518$, $p = .034$). Tukey post hoc testing revealed that practitioners who use the primary job title of "Psychologist" ($M = 1.083$, $SD = .27$) are more likely to include orthographic processing measures on evaluations when compared to practitioners who use the primary job title of "School Psychologist" ($M = 1.0$, $SD = .0$). These results suggest that Psychologists who

do evaluations outside of schools include measures of orthographic processing more frequently than school psychologists.

Barriers Faced

When asked to describe the barriers faced when identifying orthographic processing deficits in students, half of the practitioners indicated that their own lack of understanding and knowledge of the concept gets in the way (50%). Other responses reported by practitioners included access to assessment tools and challenges with their current ones (33%), time to conduct evaluations (7%), not enough data to make an informed decision (5%), and the idea that deficits in these areas can be overlooked due to them looking like deficits in other areas (2%). Five percent of practitioners indicated that they face no barriers when faced with orthographic processing deficits in students. Eighty-six percent of participants indicated that at least one point in their career they have conducted an evaluation in which a student was not reading or writing at grade level, but their cognitive testing did not lead to an identified learning disability. Of this sample, some common barriers faced when presented with these problems include ineligibility for an IEP due to not being able to classify these students as learning disabled (26%), lack of interventions and resources for how to help these students (21%), and confusion amongst school staff and family on why these students don't classify as learning disabled (10%). Conversely, 16% of participants indicated that they face no barriers when presented with these problems. Specifically, 11% indicated that this is due to that fact that their state does not require cognitive measures to identify a student with a specific learning disability.

Table 10

What barriers do you face when identifying orthographic processing deficits in students?

	N	*%*
Lack of understanding/knowledge of concept	59	50.4
Access to assessment tools/challenges with current assessment tools	39	33.3
Overlooked because they look like something else	2	1.71
Time	8	6.84
Not enough data	6	5.13
None	6	5.13
Other	6	5.13

Note. n = 117

CHAPTER VI: Discussion

The present study sheds light on school psychologists' knowledge of orthographic processing. The goal of this study was to identify school psychologists' level of familiarity with orthographic processing, their awareness of how it impacts students academically, and how deficits in this area are evaluated. The findings of this survey, summarized herein, suggest that among those school psychologists surveyed, many are familiar with the with the term "orthographic processing"; however, struggle to define its impact on academics and don't feel confident in their abilities to identify deficits in students.

Familiarity with Construct of Orthographic Processing

Frequency data analyses suggest that 94% of practitioners who participated in the study are either slightly familiar, familiar, or very familiar with the construct of orthographic processing. Those who expressed at least some familiarity were asked to describe how orthographic processing impacts overall academic performance, weaknesses in reading, and weaknesses in writing. Responses were not consistent among practitioners and typically included only one aspect of how it impacts specific areas of academics (e.g., reading fluency, poor spelling, poor decoding with irregular words, etc.). Further, a small percentage of practitioners incidentally described aspects of phonological processing in their responses. Of the 22 participants who indicated they were "very familiar" with the construct, only 8 of them described orthographic processing's impact on academics in their own words. Those who did respond to these questions provided in-depth and accurate responses suggesting a strong sense of familiarity. Further, these participants who were "very familiar" often used terms such as "orthographic coding"

and “orthographic lexicon” when describing orthographic processing. These terms did not appear in any other practitioners’ responses suggesting those who are very familiar with the topic have a great deal of knowledge and practice in this area. All in all, these results suggest that only practitioners who are very familiar with the construct of orthographic processing have extensive and accurate knowledge of how it impacts academics.

Multivariate analyses of variance (MANOVAs) were conducted to evaluate the relationship between specific variables and the level of familiarity with the construct of orthographic processing. Results showed that practitioners who have been in the field longer (15 to 20 years) have significantly more familiarity with the construct than practitioners who are newer to field. These results suggest that practitioners who have been in the field longer are more likely to have encountered students with deficits in orthographic processing and thus, have had more time and experience to become familiar with the construct. Additionally, results showed that the more academic achievement assessments conducted per year, the more familiarity a practitioner has with the construct of orthographic processing. These results suggest the more exposure one has to evaluating academic strengths and weaknesses, the more likely they are to notice strengths and weaknesses related to orthographic processing and familiarize themselves with the concept.

Knowledge of Orthographic Processing

While the majority of participants indicated they had at least some level of familiarity with the construct of orthographic processing, only half of these individuals indicated that they felt they had enough knowledge to accurately identify deficits in

students. The majority of practitioners who felt they had enough knowledge in this area to accurately identify deficits in students indicated that they obtained their knowledge of orthographic processing from their own research. This suggests that school psychology programs and continuing education courses are not covering the topic of orthographic processing as thoroughly as they should be leading to practitioners having to use their own time and resources to research the topic.

Over half of the study participants indicated that they feel as though their knowledge regarding orthographic processing helps them in making appropriate decisions with regard to interventions and recommendations. Practitioners reported that their knowledge of orthographic processing helps them with identifying students with these characteristics as learning disabled, being useful in identifying specific skill deficits in reading and writing, providing more clarity on why a student may be struggling academically, and that their knowledge of this construct forces them to dive deeper in their evaluations before coming to a conclusion (e.g., looking at work samples, more testing, etc.). Altogether, the more knowledge a practitioner has with regard to orthographic processing they better able they are to provide appropriate support for students exhibiting deficits in these areas.

Multivariate analyses of variance (MANOVAs) were conducted to evaluate the relationship between specific variables and a practitioner's knowledge of orthographic processing. Results showed a significant relationship between years employed in the field and a practitioner feeling they have enough knowledge to identify orthographic deficits in students. Results showed that practitioners who have worked in the field for 4 years or less feel they have enough knowledge regarding orthographic processing to identify

deficits and make appropriate recommendations for students when compared to practitioners who have worked in the field for 15 to 20 years. These results suggest that while those who have worked in the field longer are more familiar with the construct of orthographic processing, those who are newer to the field are more confident in their abilities to identify deficits and make recommendations. This may be a product of school psychology programs and continuing education courses providing more information on this topic, which may lead to more confidence and competence in newer professionals.

Additionally, results of a MANOVA suggested that practitioners who identify as "Bilingual School Psychologists" may feel more confident in their ability to identify and provide recommendations for students with orthographic processing deficits than those who identify as a "Psychologist". This may be impacted by coursework and overall work task differences between the two professions being that Bilingual School Psychologists have a heavier focus on psychoeducational assessment compared to individuals who go to school to become a non-school psychologist. Furthermore, it potentially may be impacted by a Bilingual School Psychologists knowledge of language and orthography differences which may lead to more confidence with identifying deficits and providing recommendations.

Accuracy Rates with Identify Deficits

Practitioners were asked to estimate the percentage of time they are successfully able to identify the cognitive processes that are related to specific characteristics of orthographic processing. Only 20% of practitioners indicated that they are able to successfully identify the cognitive processes suggesting, once again, that practitioners lack extensive knowledge in this area especially when it comes to evaluating and

identifying deficits. When asked to identify the cognitive processes that are most related to orthographic processing, the most common responses included working memory, visual-spatial processing, processing speed, and long-term storage and retrieval. However, responses were not consistent and often times only identified one specific cognitive process.

A one-way between subjects' analyses of variance (ANOVA) demonstrated that practitioners who adhere to a theoretical framework are better able to identify the cognitive processes related to characteristics of orthographic processing than those who don't. Specifically, practitioners who adhere to Neuropsychological Theory are better able to identify the cognitive processes than those who adhere to CHC Theory. These results suggest that adherence to a theoretical framework likely leads to more clarity and confidence with identifying the cognitive processes related to orthographic processing. Specifically, those who adhere to CHC Theory are often constrained in their analysis of learning abilities by using classified cognitive skills that demonstrate highly significant correlations to academic achievement skills (i.e., broad abilities). While deficits in a combination of specific broad abilities may indicate an orthographic processing weakness, there is no specific amalgamation of broad ability weaknesses that indicate an orthographic processing deficit. Practitioners who prescribe to Neuropsychology Theory are not faced with these constrains and typically have more knowledge on the topic in general.

Measures of Orthographic Processing

Results suggested that over half of practitioners include measures of orthographic processing on all reading and writing evaluations. The most popular measures of

orthographic processing among survey participants include the WIAT-4: Spelling, Orthographic Fluency, Orthographic Choice Subtests, KTEA-III: Spelling Subtest the Feifer Assessment of Reading: Orthographic Processing Subtest, WJ IV ACH: Spelling Subtest. A small percentage (24%) of participants indicated that they include orthographic processing measures on all of their evaluations no matter the referral concern, while others (38%) indicated they only include these measures on reading and writing evaluations. Further, only 9% of practitioners indicated that they include orthographic processing measures if they notice poor spelling, but good reading, while 6% indicated that they use these measures if informal data (e.g., writing samples, classwork, observations) indicates a student's orthographic processing may be a concern. These results suggests that an orthographic processing deficit may be overlooked entirely if no concerns are raised about a student's reading or writing level.

Practitioners who include measures of orthographic processing in their evaluations appear to be split on their feelings towards the comprehensiveness of current measures. Those who indicated that they don't find current measures comprehensive indicated that their major concerns include issues with the number of subtests or test items that tap into orthographic processing, feeling as thought the current measures don't delineate the exact problem, feeling like informal methods are more useful than measures of orthographic processing, lack of their own knowledge with regard to orthographic processing, and orthographic processing overall being a difficult skill to assess. These results suggest that there are many weaknesses with the current measures of orthographic processing and that they likely play a role in a practitioner's ability to identify deficits. Further, this supports findings from the literature that standardized assessments are

unable to pick up on orthographic processing weaknesses. Paired with the knowledge that there is a marginal number of assessments that measure orthographic processing, this is just further evidence that deficits in this area are likely going unidentified.

MANOVA analyses suggested that those who have been employed in the field for 30 or more years are more likely to include measures of orthographic processing than those who have been in the field for less than 30 years. This may be a result of more experienced practitioners having more resources that allows them include measures on evaluations. Furthermore, these practitioners may also be more aware of deficits in this area due to their experience and knowledge base. Additionally, results suggest that practitioners who use the primary job title of "Psychologist" are more likely to include orthographic processing measures on evaluations compared to practitioners who use the primary job title of "School Psychologist" suggesting that Psychologists who do evaluations outside of schools include measures of orthographic processing more frequently than school psychologists. This is likely a result of a lack of orthographic assessment measures being available in a school setting.

Barriers Faced by Practitioners

When asked to describe the barriers faced when identifying orthographic processing deficits in students, half of the practitioners indicated that their own lack of understanding and knowledge of the concept gets in the way. Other responses reported included access to assessment tools and challenges with their current tools, the amount of available time to conduct evaluations, not enough data to make an informed decision, and the idea that deficits in orthographic processing can be overlooked due to looking like deficits in other areas. Further, a large number of practitioners indicated that at least one

time in their career they have evaluated a student with reading and writing deficits whose cognitive abilities did not lead to an identified learning disability. When this happens, students are typically ineligible for an IEP, so no interventions or support services are required and confusion amongst school staff and families ensues. Additionally, for students with orthographic processing deficits who do meet criteria for a learning disability, interventions, and resources for how to help these students are minimal. Only 5% of participants indicated that they face no barriers when faced with orthographic processing deficits in students. The majority of these practitioners work in states that do not require cognitive measures when identifying a student with a specific learning disability, suggesting that current cognitive assessments are likely leading practitioners to overlook orthographic processing. All in all, these results suggest that there are currently many barriers to identifying orthographic processing deficits in students which likely contributes to many of these students not being identified as learning disable, leading to no interventions and thus, no improvement.

Limitations

There were limitations to this study. For one, it was a relatively small sample size of school psychologists with the majority of participants from New York State. In the future, it would be ideal to have a sample size of over 300 school psychologists from a variety of states which would potentially lead to more insight into this topic, as well as more diversity in participants. Additionally, there may be a selection/sampling bias because the participants who chose to respond to this survey likely had some knowledge of orthographic processing while those who didn't have any likely avoided the survey when reading the title and description. Comparatively, approximately one-quarter of

survey participants did not complete the survey all the way through and stopped when asked questions related to orthographic processing. This could be a product of response bias and participants feeling they lack the knowledge to answer the questions correctly. Thus, it may be beneficial for future studies in this area to provide incentives for individuals to gain a more comprehensive sampling.

Furthermore, a portion of survey participants did not answer any short-answer questions, especially when asked to describe orthographic processing's impact on academic areas in their own words. This was an important component to this study as it allowed the examiner to distinguish practitioners who felt they had sufficient knowledge and could back up their knowledge through their own words and those who couldn't. Majority of the short-answer questions appeared towards the end of the survey so future studies may want to have these responses towards the beginning. Despite these limitations, the findings provide us with a snapshot of a school psychologists' knowledge of orthographic processing.

CHAPTER VII: Implications for the Profession of School Psychology

Important findings from this research study reflect clear differences in school psychologists' knowledge of orthographic processing. There is currently extensive research regarding orthographic processing and its impact on student's ability to read and write. However, prior to this study there was a clear gap in the research in terms of the knowledge school psychologists have on this topic and how deficits in this area are evaluated. This study is one of the first steps towards closing this gap and is a significant benefit for the field of school psychology, practice, and research.

Findings suggested that school psychologists who have sufficient knowledge of orthographic processing seek out information on their own. Further, being that most primary grade teachers focus heavily on the development of phonological awareness, orthographic awareness is often neglected. School psychologists play a large role in making sure teachers are informed of the differences and are making sure academic instruction taps into both orthographic and phonological awareness. In turn, having teachers who are knowledgeable about orthographic processing may lead to earlier identification and intervention. Thus, school psychology programs and continuing education courses need to place more of an emphasis on these deficits and how to properly identify them in students. Not only will this allow practitioners who are entering the field to start applying this knowledge earlier on, but it may also help teachers and other school staff members to better understand what deficits in this area look like and the interventions and related services they can provide.

Further, insight into orthographic processing seems to be impacted by the resources that schools can provide. School psychologists who work in wealthier school

districts tend to have more access to measures of orthographic processing which significantly impacts their ability to assess this area accurately. All students, no matter their socioeconomic status, should have access to a comprehensive psychoeducational evaluation. School districts not being able to support school psychologists with the tools and resources needed to evaluate areas of orthographic processing leads to deficits being overlooked and not intervened with appropriately. On top of this, the assessment measures that provide insight into orthographic processing are not found to be extremely comprehensive and are also lacking in number. While updates have been made to popular academic achievement assessments (e.g., WIAT-4) to include subtests that tap into this area, more updates are necessary to make it easier for practitioners to identify deficits.

Taken together, the overall lack of substantial knowledge school psychologists have regarding orthographic processing has many implications for school districts, continuing education courses, and graduate training programs.

Appendix A

Survey

1. Orthographic processing deficits can play an important role in the development of reading and writing skills, but we have limited knowledge regarding how measures associated with this construct are incorporated into the assessment practices of current school psychologists. This survey will explore school psychologists' knowledge of orthographic processing and its relation to reading and writing development and whether or not they are utilizing their knowledge when evaluating students with reading and writing issues. This study is being conducted by Shannon Santoro, M.A., M.S., along with her mentor, Dr. Marlene Sotelo-Dynega, as part of her dissertation within the department of Psychology at St. John's University.

   By choosing to participate in this study, you will be asked to complete an online survey regarding your knowledge about orthographic processing, how these processes related to academic performance and whether or not you incorporate measures of these abilities when you evaluate students. This survey should take approximately 10-20 minutes of your time. There are no known risks associated with your participation in this research beyond those of everyday life. Although you will receive no direct benefits, this research will help us shed light on how orthographic processing deficits are identified within schools and to ultimately help students who are struggling with these difficulties.

   Considering that no identifying information will be requested, your responses to the survey will be completely anonymous. Please be advised that your participation in this study is voluntary, and you may refuse to participate or withdraw at any time without penalty. You also have the right to skip or not answer any question that you prefer not to answer.

   If there is anything about the study, or your participation that is unclear, or that you do not understand, or if you have questions or wish to report a research related problem you may contact Shannon Santoro at shannon.santoro18@my.stjohns.edu or Dr. Marlene Sotelo-Dynega at 718-990-1545 or sotelodm@stjohns.edu, School Psychology Department, St. John's University, 8000 Utopia Parkway queens, NY 11439 . For questions about your

rights as a research participant, you may contact the Human Subjects Review Board, St. John's University, (718) 990-1440.

a) I am at least 18 years of age and agree to participate in this survey.
b) I do not agree to participate in this survey.

Section 1: Demographics/Background Information

2. Please select your gender from the choices listed below:
    a) Male
    b) Female
    c) Non-binary / third gender
    d) Prefer not to say

3. Please select the race and/or ethnicity group(s) that you identify with (please select all that apply):
    a) American Indian/Alaskan Native
    b) Asian
    c) Black or African American
    d) Caucasian
    e) Native Hawaiian or Other Pacific Islander
    f) Hispanic/Latino
    g) I prefer not to answer this question

4. Please indicate the highest degree that you have earned:
    a) Bachelors Degree
    b) Masters Degree (30 credit degree)
    c) Specialist Degree (60+ credit degree)
    d) Doctoral Degree
    e) Other _____

5. Please select the degree that you earned:
    a) Bachelor of Arts
    b) Master of Science
    c) Master of Arts
    d) Master of Education
    e) Doctor of Philosophy
    f) Doctor of Psychology
    g) Doctor of Education
    h) Other _____

6. What subject area was your degree in?

_____

7. Are you currently employed?
    a) Yes
    b) No
    c) I prefer not to respond

8. Select your current employment setting:
    a) Public School
    b) Private School-Sectarian
    c) Private School-Non-Sectarian
    d) University/College
    e) University/College Psychological Services Center
    f) Private Practice
    g) Hospital
    h) Other

9. Please select the age/grade level(s) with which you work:
    a) Early Intervention (Ages 0-2)
    b) Preschool (Ages 3-5)
    c) Primary Grades (K-2)
    d) Elementary Grades (K-4)
    e) Middle School (5-8)
    f) High School (9-12)
    g) College (13+)

10. What is your PRIMARY job title?
    a) School Psychologist
    b) Bilingual School Psychologist
    c) Psychologist
    d) Director of Special Education
    e) Chairperson, Committee on Special Education
    f) Chairperson, Committee on Preschool Special Education
    g) Other _____

11. Please select the number of years that you have been, or were employed (in any role) within the profession of school psychology:
    a) 0 years (currently a student)
    b) 1-4 years
    c) 5-10 years
    d) 11-14 years
    e) 15-20 years
    f) 21-25 years
    g) 26-30 years
    h) 30+ years

12. Please select reason for unemployment:
    a) I am currently a student
    b) I am retired
    c) I prefer not to answer this question
    d) Other _____

13. In which State are you, or have you been a school psychologist?

_____

14. In your State, to practice as a school psychologist in a public school, what credential must you possess?
    a) Certification granted by the State Department of Education
    b) License granted by a Local Educational Agency
    c) License granted by a Psychology Board
    d) I Don't Know
    e) Other _____

15. What credential(s) do you possess? (Select all that apply)
    a) Certification
    b) Licensed Psychologist
    c) Licensed School Psychologist
    d) Other _____

16. To maintain your credential, are you required to receive a certain number of continuing education credits?
    a) Yes
    b) No
    c) I Don't Know

17. How would you describe your districts socio-economic status?
    a) Low SES
    b) Middle SES
    c) Upper-Middle SES
    d) High SES

Section 2: Study Questions

18. In your role as a school psychologist, do you currently conduct cognitive assessments?
    a) Yes
    b) No

19. How much of your time do you devote to the administration of cognitive assessments?
    a) 100% of my time
    b) 90 - 99% of my time
    c) 80-89% of my time
    d) 70-79% of my time
    e) 60-69% of my time
    f) 50-59% of my time
    g) 40-49% of my time
    h) 30-39% of my time
    i) 20-29% of my time
    j) 10-19% of my time
    k) 1-9% of my time

20. In your role as a school psychologist, do you currently conduct academic achievement assessments?
    a) Yes
    b) No

21. How much of your time do you devote to the administration of academic achievement assessments?
    a) 100% of my time
    b) 90 - 99% of my time
    c) 80-89% of my time
    d) 70-79% of my time
    e) 60-69% of my time
    f) 50-59% of my time
    g) 40-49% of my time
    h) 30-39% of my time
    i) 20-29% of my time
    j) 10-19% of my time
    k) 1-9% of my time

22. On average, how many academic achievement assessments do you conduct each year?

    _____

23. Do you personally conduct all of the evaluations that are assigned to you?
    a) Yes
    b) No

24. Who helps you conduct evaluations that are assigned to you?
    a) Intern
    b) Testing Technician
    c) Another School Psychologist
    d) Other _____

25. Do your assessment methods adhere to theoretical framework (e.g., CHC, PASS, Neuropsychological)?
    a) Yes
    b) No
    c) I Don't Know

26. Select the PRIMARY theoretical framework that you follow:
    a) Spearman's General Intelligence
    b) Thurston's Primary Mental Abilities
    c) Cattell-Horn-Carroll Theory of Human Cognitive Abilities (CHC Theory)
    d) Sternberg's Triarchich Theory of Intelligence
    e) Naglieri and J.P. Das's PASS Theory of Intelligence
    f) Gardner's Multiple Intelligence Theory
    g) Information Processing Center
    h) Neuropsychological Theory
    i) Other _____

27. How do you determine what assessment measures to use (select all that apply):
    a) My employment setting dictates the tests that I can use
    b) Based on the theory to which I prescribe
    c) Based on client characteristics
    d) Based on the referral question
    e) Based on the tests that I am most comfortable with
    f) Based on the psychometric properties of the test
    g) Based on the hypotheses I have generated about the nature of the problem
    h) ☐ Other _____

28. Select the test you prefer to use as your core battery with examinees who are suspected of having a specific learning disability:
    a) I do not use cognitive tests to identify this disorder
    b) Bateria IV Woodcock-Muñoz: Preubas de habilidades cognitivas
    c) Cognitive Assessment System, Second Edition (CAS-II)
    d) Delis-Kaplan Executive Functioning System (D-KEFS)
    e) Differential Ability Scales, Second Edition (DAS-II)
    f) Kaufman Adolescent and Adult Intelligence Test (KAIT)
    g) Kaufman Assessment Battery for Children, Second Edition Normative Update (KABC-II NU)
    h) Leiter International Performance Test, Third Edition (Leiter-3)
    i) NEPSY-II
    j) Reynolds Intellectual Assessment Scale (RIAS)
    k) Stanford-Binet Intelligence Scales-Fifth Edition (SB5)
    l) Test of Nonverbal Intelligence-Fourth Edition (TONI-4)
    m) Universal Nonverbal Intelligence Test 2 (UNIT 2)
    n) Wechsler Adult Intelligence Scale-Fourth Edition (WAIS-IV)
    o) Wechsler Intelligence Scales for Children-Fifth Edition (WISC-V)
    p) Wechsler Intelligence Scales for Children-SPANISH-Fifth Edition (WISC-V)
    q) Wechsler Nonverbal Scale of Ability (WNV)
    r) Wechsler Preschool and Primary Scale of Intelligence –Fourth Edition (WPPSI-IV)
    s) Woodcock-Johnson Tests of Cognitive Abilities-Fourth Edition (WJ IV COG)
    t) Other _____

29. Select the tests you prefer to use as your measure of achievement with examinees who are suspected of having a specific learning disability in reading and/or writing (select all that apply):
    a) I do not use achievement tests to identify this disorder
    b) Bateria IV Woodcock-Munoz: Pruebas de aprovechamiento (Bateria IV)
    c) Feifer Assessment of Reading (FAR)
    d) Feifer Assessment of Writing (FAW)
    e) Gray Oral Reading Tests, Fifth Edition (GORT-5)
    f) Gray Silent Reading Tests (GSRT)
    g) Kaufman Test of Educational Achievement, Third Edition (KTEA-III)
    h) Nelson Denny Reading Test
    i) Oral and Written Language Scales, Second Edition (OWLS-II)
    j) Process Assessment of the Learner, Second Edition Reading and Writing (PAL-II RW)
    k) Test of Early Written Language, Third Edition (TWEL-3)
    l) Test of Written Language, Fourth Edition (TOWL-4)
    m) Test of Word Reading Efficiency, Second Edition (TOWRE-2)
    n) Wechsler Individual Achievement Test, Third Edition (WIAT-III)
    o) Wechsler Individual Achievement Test, Fourth Edition (WIAT-IV)
    p) Wide Range Achievement Test, Fifth Edition (WRAT-5)
    q) Woodcock-Johnson Tests of Achievement, Fourth Edition (WJ IV ACH)
    r) Word Identification and Spelling Test (WIST)
    s) Other _____

30. How familiar are you with the construct of orthographic processing?
    a) Not Familiar
    b) Slightly Familiar
    c) Familiar
    d) Very Familiar

31. In your own words please describe to the best of your knowledge what orthographic processing is and how it relates to academic performance.

_____

32. Please describe to the best of your knowledge how weaknesses in orthographic processing manifest in reading.

_____

33. Please describe to the best of your knowledge how weaknesses in orthographic processing manifest in writing.

_____

34. Do you feel like you have enough knowledge regarding orthographic processing to identify deficits in students?
    a) Yes
    b) No

35. Where did you obtain the most knowledge regarding orthographic processing in students?
    a) School Psychology Program
    b) Continuing Education Course
    c) Own Research
    d) Other _____

36. What is the estimated percentage of time that you are able to successfully identify the cognitive process that are related to specific characteristics of orthographic processing?
    a) 100% of the time
    b) 90-99% of the time
    c) 80-89% of the time
    d) 70-79% of the time
    e) 60-69% of the time
    f) 50-59% of the time
    g) 40-49% of the time
    h) 30-39% of the time
    i) 20-29% of the time
    j) 10-19% of the time
    k) 1-9% of the time

37. What cognitive processes do you think are involved with orthographic processing?

_____

38. When evaluating students with reading and writing difficulties, do you include measures of orthographic processing?
    a) Yes
    b) No

39. What makes you decide to include measures of orthographic processing in an evaluation?

_____

40. Select all measures of orthographic processing that you use (select all that apply):
    a) Bateria IV Woodcock-Munoz: Pruebas de aprovechamiento (Bateria IV) Ortografia Subtest
    b) Feifer Assessment of Reading (FAR): Orthographic Processing Subtest
    c) Kaufman Test of Educational Achievement, Third Edition (KTEA-III): Spelling Subtest
    d) Process Assessment of the Learner, Second Edition Reading and Writing (PAL-II RW): Orthographic Coding, Orthographic Spelling Subtests
    e) Test of Irregular Word Reading Efficiency (TIWRE)
    f) Test of Orthographic Competence (TOC)
    g) Test of Silent Word Reading Fluency – Second Edition (TOSWRF – 2)
    h) Test of Written Language, Fourth Edition (TOWL-4): Spelling Subtest (
    i) Wechsler Individual Achievement Test Fourth Edition (WIAT-4): Spelling, Orthographic Fluency, Orthographic Choice Subtests
    j) Woodcock-Johnson Tests of Achievement, Fourth Edition (WJ IV ACH): Spelling Subtest
    k) Other _____

41. Do you find that these measures of orthographic processing are comprehensive?
    a) Yes
    b) No

42. Why don't you find these measures of orthographic processing to be comprehensive?

_____

43. What barriers do you face when identifying an orthographic processing deficit in a student?

_____

44. Have you conducted an evaluation in which a student is not reading or writing at grade level, but their cognitive testing doesn't lead to an identified learning disability?
    a) Yes
    b) No

45. What are some of the barriers you face when presented with these problems?

_____

46. Do you feel as though your knowledge regarding orthographic processing assists you in making appropriate decisions when presented with a student with below grade level reading and writing and average cognitive abilities?
    a) Yes
    b) No

47. How does your knowledge of orthographic processing assist in your ability to make appropriate decisions regarding students with below grade level reading and writing and average cognitive abilities?

_____

Appendix B

Recruitment Statement

Dear School Psychologist,

I am inviting you to participate in an online research survey that I am conducting for my dissertation. This study seeks to explore school psychologists' knowledge of orthographic processing and its relation to reading and writing development. Participants must be practicing school psychologists for at least one year in a public or private school setting and work with children who have specific learning disabilities.

If you are interested in participating in this survey, please take the online survey available at: https://stjohns.az1.qualtrics.com/jfe/form/SV_da1GjT3RxJ6e1NQ

It should take approximately 20 minutes to complete. Your participation is voluntary. You may choose to withdraw at any point without any penalty to you. In addition, you may skip any questions you choose. Your answers will remain anonymous. There are no foreseeable risks to participation in the study.

Although you will receive no direct benefits, this research will help us shed light on how orthographic processing deficits are identified within schools and ultimately help students who are struggling with these difficulties.

I appreciate your participation and feedback in order to provide meaningful and useful data for my dissertation and for future knowledge in the field.

If you have any questions, please email me at shannon.santoro18@my.stjohns.edu.

Thank you,

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REFERENCES

Alfonso, V. & Flanagan, D. (2018.), *Essentials of specific learning disability identification, 2e.* John Wiley & Sons Inc.

Apel, K. (2011). What is orthographic knowledge? *Language, Speech, and Hearing Services in Schools*.

Bailey, C.E., Manis, F.R., Pedersen, W.C., & Seidenberg, M.S. (2004). Variation among developmental dyslexics: Evidence from a printed-word-learning task. Journal of Experimental Child Psychology, 87, 125-154.

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. Journal of psycholinguistic research, 39(2), 141-163.

Berninger, V. W., Lee, Y. L., Abbott, R. D., & Breznitz, Z. (2013). Teaching children with dyslexia to spell in a reading-writers' workshop. Annals of Dyslexia, 63(1), 1-24.

Boros, M., Anton, J. L., Pech-Georgel, C., Grainger, J., Szwed, M., & Ziegler, J. C. (2016). Orthographic processing deficits in developmental dyslexia: Beyond the ventral visual stream. *NeuroImage*, *128*, 316-327.

Breaux, K. C. (2020). Wechsler Individual Achievement Test Fourth Edition. Bloomington, MN: Pearson.

Brooks, A. D., Berninger, V. W., & Abbott, R. D. (2011). Letter naming and letter writing reversals in children with dyslexia: Momentary inefficiency in the phonological and orthographic loops of working memory. Developmental neuropsychology, 36(7), 847-868.

Burt, J. S. (2006). What is orthographic processing skill and how does it relate to word identification in reading?. *Journal of Research in Reading*, *29*(4), 400-417.

Castles, A., & Coltheart, M. (1993). Varieties of developmental dyslexia. *Cognition*, *47*(2), 149-180.

Chung, P., & Patel, D. R. (2015). Dysgraphia. *International Journal of Child and Adolescent Health*, *8*(1), 27.

Chung, P. J., Patel, D. R., & Nizami, I. (2020). Disorder of written expression and dysgraphia: definition, diagnosis, and management. *Translational pediatrics*, *9*(Suppl 1), S46.

Commodari, E., Guarnera, M., Di Stefano, A., & Di Nuovo, S. (2020). Children learn to read: how visual analysis and mental imagery contribute to the reading performances at different stages of reading acquisition. *Journal of psycholinguistic research*, *49*(1), 59-72.

Cunningham, A. E., & Stanovich, K. E. (1990). Assessing print exposure and orthographic processing skill in children: A quick measure of reading experience. Journal of Educational Psychology, 82(4), 733.

Deacon, S. H., Pasquarella, A., Marinus, E., Tims, T., & Castles, A. (2019). Orthographic processing and children's word reading. *Applied Psycholinguistics*, *40*(2), 509-534.

Feifer, S.G. (2018). The neuropsychology of reading disorders. In V. Alfonso & D. Flanagan (Eds.), *Essentials of specific learning disability identification, 2e (pp*. 29-58). John Wiley & Sons Inc.

Friedmann, N., & Coltheart, M. (2018). 35. Types of developmental dyslexia. In *Handbook of Communication Disorders* (pp. 721-752). De Gruyter Mouton.

Goforth, A. N., Farmer, R. L., Kim, S. Y., Naser, S. C., Lockwood, A. B., & Affrunti, N. W. (2021). Status of school psychology in 2020: Part 1, demographics of the NASP membership survey. *NASP Research Reports*, *5*(2), 1-17.

Grainger, J., & Hannagan, T. (2014). What is special about orthographic processing?. *Written Language & Literacy*, *17*(2), 225-252.

Hepner, C., McCloskey, M., & Rapp, B. (2017). Do reading and spelling share orthographic representations? Evidence from developmental dysgraphia. *Cognitive neuropsychology*, *34*(3-4), 119-143.

Holmes, V. M., Malone, A. M., & Redenbach, H. (2008). Orthographic processing and visual sequential memory in unexpectedly poor spellers. *Journal of Research in Reading*, *31*(1), 136–156.

Hultquist, A. M. (1997). Orthographic processing abilities of adolescents with dyslexia. Annals of dyslexia, 47(1), 89-114.

Individuals with Disabilities Education Act, 34 C.F.R. §300.8 (2007)

Irwin, V., Zhang, J., Wang, X., Hein, S., Wang, K., Roberts, A., ... & Purcell, S. (2021). Report on the Condition of Education 2021. NCES 2021-144. *National Center for Education Statistics*.

Joseph, L. M., Wargelin, L., & Ayoub, S. (2016). Preparing school psychologists to effectively provide services to students with dyslexia. *Perspectives on Language and Literacy*, *42*(4), 15-24.

Kohnen, S., Nickels, L., Castles, A., Friedmann, N., & McArthur, G. (2012). When 'slime'becomes 'smile': developmental letter position dyslexia in English. *Neuropsychologia*, *50*(14), 3681-3692.

Manis, F.R., Seidenberg, M.S., Doi, L.M., McBride-Chang, C. & Peterson, A. (1996). On the bases of two subtypes of developmental dyslexia. Cognition, 58, 157-195.

Mather, N., Roberts, R. , Hamill, D.D., & Allen, E.A. (2008). Test of Orthographic Competence. Pro-Ed, Inc.

Mather, N., Hammil, D.D., Allen, E.A. & Roberts, R. (2014). TOSWRF-2: Test of Silent Word Reading Fluency, 2nd Ed. PRO-ED, Inc.

Mesman, G. R., & Kibby, M. Y. (2011). An Examination of Multiple Predictors of Orthographic Functioning. *Journal of Learning Disabilities*, *44*(1), 50–62.

National Association of School Psychologists. (2011). *NASP Position Statement: Identification of students with Specific Learning Disabilities.* Bethesda, MD: NASP.

National Center for Educational Statistics. (2019). Retrieved from https://nces.ed.gov/nationsreportcard/reading/

Reynolds, C. and Kamphaus, R. (2007). Test of Irregular Word Reading Efficiency. Ann Arbor, MI: Academic Therapy Publications.

Rothe, J., Cornell, S., Ise, E., & Schulte-Körne, G. (2015). A comparison of orthographic processing in children with and without reading and spelling disorder in a regular orthography. *Reading and Writing*, *28*(9), 1307-1332.

Seghier, M. L. (2013). The angular gyrus: multiple functions and multiple subdivisions. *The Neuroscientist*, *19*(1), 43-61.

Siegel, L. S., Share, D., & Geva, E. (1995). Evidence for superior orthographic skills in dyslexics. Psychological science, 6(4), 250-254.

Vaessen, A., Bertrand, D., Tóth, D., Csépe, V., Faísca, L., Reis, A., Blomert, L., 2010. Cognitive
development of fluent word reading does not qualitatively differ between transparent
and opaque orthographies. J. Educ. Psychol. 102, 827–842.

Vidyasagar, T. R., & Pammer, K. (2010). Dyslexia: a deficit in visuo-spatial attention, not in phonological processing. *Trends in cognitive sciences*, *14*(2), 57-63.

Wang, H. C., Nickels, L., Nation, K., & Castles, A. (2013). Predictors of orthographic learning of regular and irregular words. *Scientific Studies of Reading*, *17*(5), 369-384.

Wang, H. C., Marinus, E., Nickels, L., & Castles, A. (2014). Tracking orthographic learning in children with different profiles of reading difficulty. *Frontiers in human neuroscience*, *8*, 468.

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