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The Role of Occupational Therapy in School-Aged Youth Literacy: A Scoping Review

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Abstract

Since the passage of the IDEA Act in 1975, pediatric occupational therapists have been working to improve children's literacy skills. From the sensory-based assessment and interventions of Ayres (1972) to the Occupations of Reading Practice Model created by Grajo and Chandler (2017), the field of occupational therapy has come a long way in understanding how to treat children with deficits in reading, writing, and other forms of communication. The goal of this study was to understand how occupational therapists are currently working with school-aged youth concerning their literacy skills. Six databases were searched using terms related to occupational therapy and literacy in school-aged youth. Inclusion criteria for the articles included occupational therapist/occupational therapy assistant/occupational therapy, a target age range of k-12, a publication range between 1975 through the present, and published in the English language. Seventy-nine percent of the results occurred between 2006 to present. Sixty-one articles met the inclusion criteria; after removing systematic reviews and meta-analyses, forty-six articles were analyzed for this study. The thematic analysis revealed that occupational therapy practitioners are addressing factors related to perception, vision, and cognition with school-aged youth. The occupational therapy practitioners mainly assessed skills such as handwriting. The most used assessments were the Minnesota Handwriting Test and the Evaluation Tool of Children's Handwriting Manuscript.

Keywords: Occupational therapy, occupational therapy assistant, literacy, school-aged youth, scoping review

Introduction

Much of the curriculum in public and private schools nationally and internationally is based around a child's literacy skills. Literacy is defined as the ability to use printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential connections to the daily occupations that affect reading, learning, quality of life, and community integration (Francis & Beck, 2018). Without learning and becoming proficient in these foundational skills, a child's ability to succeed throughout grade school, post-secondary education, and career has the potential to be hindered. In fact, according to a longitudinal study completed by Hernandez (2011), students who do not display proficiency in reading by the time they are in third grade are four times more likely not to graduate.

In order to ensure that every child obtains proficiency in literacy skills, a variety of professionals, including teachers, intervention specialists, para-educators, speech-language pathologists, and occupational therapists, must work together. Occupational therapists are a crucial part of this team and are one of the few professionals that can provide children with support inside and outside the classroom. Occupational therapists work with children by providing interventions that address performance patterns, performance skills, and client factors within various contexts and through various occupations (American Occupational Therapy Association [AOTA], 2020). Specifically, school occupational therapists and occupational therapy assistants support children's academic and non-academic outcomes, including social skills, math, reading, writing, behavior management, recess, participation in sports, self-help skills, prevocational/vocational participation, transportation, and more (AOTA, 2014). Outside of school, occupational therapists who work in outpatient clinics can also assist in these areas.

Concerning literacy, occupational therapists can provide intervention and enrichment in handwriting, reading, verbal and non-verbal communication, and communication via technology

and assistive devices. With many children receiving occupational therapy also having a diagnosis that affects reading and communication (such as dyslexia, autism spectrum disorder, and others), it would make sense that interventions would tend to focus on these areas. Yet, occupational therapists within the United States have reported that the most common reason for referral to OT services within a school setting was issues with handwriting (Chandler, 1994). Intervention and evaluation within the area of handwriting requires a therapist to consider lower-level perceptual motor skills, including visual-motor coordination, as well as higher-level cognitive skills, such as executive functioning, so it makes sense that OTs would have the skills needed to intervene in this area (Case-Smith et al., 2011). Each of the literacy skills previously mentioned require similar lower- and higher-level skills, which leads one to wonder why handwriting is the more common reason for referral.

Literature Review

To understand the breadth of occupational therapy's role in literacy for school-aged youth, it is important to conduct a thorough review of current literature surrounding the topic. The term "literacy" has been broken down into four specific skills and abilities: reading, writing, speaking, and listening skills (Clark, 2016). Each of these skills should be addressed simultaneously and throughout intervention to provide each child with a firm foundation for growth in their development of literacy (Hanser, 2010). Four emergent literacy skills to aid school-aged youth in their literacy interventions have also been identified by the National Early Literacy Panel, including alphabet knowledge, phonological awareness, print knowledge, and name writing (Shanahan & Lonigan, 2010). Alphabet knowledge is the knowledge of the names and sounds associated with printed letters. Phonological awareness is the ability to detect, manipulate, or analyze the auditory aspects of spoken language (including the ability to distinguish or segment words, syllables, or phonemes), independent of meaning. Print knowledge

includes concepts of print and early coding of written words and letters. Name writing is the ability to write letters in isolation on request or to write one's own name (NELP, 2008).

These emergent literacy skills offer areas of intervention among the three stages of literacy: pre-literacy, emergent literacy, and early literacy (Clark, 2016; Dunst et al., 2006). The National Literacy Panel also defined the three stages of literacy as pre-literacy, emergent literacy, and early literacy. Pre-literacy spans from the age of 1-3 years old, emergent literacy spans from the age of 4-6 years old, and early literacy begins at the age of formal education (NELP, 2008). Research within these stages of literacy has demonstrated that literacy skills begin to form as early as birth, which further proves the importance of early intervention (Hanser, 2010).

By providing intervention within these areas, occupational therapists can provide intervention to increase literacy rates within school-aged populations. This is imperative because, of the students who struggle with literacy, one in six will not graduate from high school as scheduled (Hernandez, 2011). The impact of poor literacy skills can be worsened by the impact of poverty and lack of access to high-quality and high-performing schools. Race has also been found to play a role as Black and Hispanic third graders who do not have adequate reading skills are twice as likely to not graduate high school compared to their White classmates (Hernandez, 2011). With approximately 66% of eighth graders in the United States scoring "below proficient" in 2015, occupational therapy has the unique opportunity to combat these staggering statistics using occupation-based interventions and assessments (Clark, 2016).

Sensory Integration and Occupational Therapy

When considering the support that occupational therapy professionals can provide to school-aged youth during the three stages of literacy, there are many ways in which occupational therapists can contribute to the success of their clients. The earliest examples of contributions from occupational therapists to literacy assessment and intervention may be the work of A. Jean Ayres, an occupational therapist who devoted her professional life to creating the Sensory Integration Theory. Ayres (1972) believed that those with auditory processing and reading difficulties could be identified "with tests of auditory perception and various language functions" (p. 236). Ayres (1972) also discussed several interventions that she found to improve the symptoms of comorbid auditory processing and reading disorders, including "very elementary, pre-language and non-cognitive activity which elicits sensations from the body and reflex and adaptive responses to them…" (p. 242). Today, occupational therapists tend to work collaboratively with education teams and curriculum committees to incorporate Universal Design for Learning into their curriculum and education practices (Clark, 2016; Grajo & Chandler, 2014; Hanser, 2010). Working with each student to help identify his or her own literacy barriers and interventions to break down barriers are vital to support literacy of students (Clark, 2016). The Occupation of Reading practice model encourages individualized interventions in which the child is allowed to choose his or her reading materials, reading environment, and ways of incorporating literacy skills into his or her academic efforts (Grajo & Chandler, 2014). These individualized interventions lead to increased confidence and increased ability to generalize literacy skills across various contexts (Grajo & Chandler, 2014).

Assessments

For occupational therapists and other professions to monitor and improve literacy skills of school-aged youth, it is imperative to determine which assessments give a holistic

understanding of the child's literacy skills (strengths and weakness') (Clark, 2016). There are seven main reading assessments prevalent in the literature that occupational therapists may use to assess reading ~~dis~~abilities and deficits in preschool through third grade. These include the Inventory of Reading Occupations (IRO), the Inventory of Reading Occupations-Pediatric (IRO-Pedi), the Dynamic Indicators of Basic Early Literacy Skills (DIBELS), the Woodcock Reading Mastery Test, the Gray Oral Reading Test (GORT), the Test of Word Reading Efficiency Second Edition (TOWRE-II), and the Woodcock Johnson Tests Fourth Edition (WJ-IV). However, some assessments are more common in the literature of the occupational therapy profession compared to others. For example, the IRO assessment was developed in order to view reading as a childhood occupation and the influence of preference and environment, motivation, engagement, interest, and attention (Grajo et al., 2016).

Compared to the IRO, the DIBELS is a set of brief assessments for children in grade levels pre-kindergarten to third grade (Arnaud & Gutman, 2020). It is used to measure those at risk for early reading failure, to track reading progress, and to assess the effectiveness of an intervention (Arnaud & Gutman, 2020). This assessment helps to identify children in the early elementary age range who might be at risk for literacy challenges. In addition, children with reading difficulties might engage with fewer reading media and have a lower sense of proficiency compared to typical readers (Grajo & Candler, 2018). Both the IRO and IRO-Pedi aim to support an occupation and participation approach to reading intervention (OPARI) based upon the Occupational Adaptation Model (Grajo & Candler, 2018).

There is a continuous evolution and development of new reading assessments to evaluate children on their reading performance. Two major assessments emerging in research in which practitioners and other personnel should be aware of are the Early Literacy Skills Assessment Tool (ELSAT) and the Visuospatial Working Memory Assessment (VWMA). The ELSAT

addresses one major gap in research regarding literacy skills in kindergarten children. Iyer et al. (2019) suggests children develop early literacy skills (ELS) around the age of preschool can be predictive of reading success at the age of third grade, and there is no current recommendation for routine developmental screening of preschool children (p. 465). Visuospatial working memory is one of the main parts of working memory necessary for children to complete daily occupational activities and enables them to retain and manipulate information to perform certain activities such as reading (Wangkawan et al., 2020). Thus, the VWMA was developed to fill in the absence of visuospatial working memory assessments relevant to occupational therapy settings.

Interventions

Incorporating interventions that address emergent literacy skills is important to guide therapeutic activities and intervention techniques. This is especially true for children with disabilities, who may not have the same exposure to reading materials as their same-age peers due to the many challenges their families face (Hanser, 2010). For instance, the use of higher-level questioning, encouraging storytelling to expand vocabulary, and expanding our population's vocabulary knowledge through reading books in their leisure time are recommended ways of improving a child's literacy skills (Hanser, 2010). The use of evidence-based practices to support literacy interventions is also important to provide the most efficient and reimbursable treatment for school-aged youth. The use of assistive technology that meets the needs of school-aged youth in literacy interventions is also effective in allowing occupational therapy professionals to support literacy (Clark, 2016).

Dyslexia and Occupational Therapy

Aside from literacy intervention for typically developing school-aged youth, occupational therapy also has a role to play to meet the needs of school-aged youth with reading disabilities,

as well. For example, occupational therapists can follow through with early interventions to remediate reading skills impacted by dyslexia. While not all intervention tools and prediction strategies for dyslexia can be performed by occupational therapists, treatment for the condition can be facilitated by occupational therapists. Occupational therapists can provide the unique service of working with speech-language pathologists, teachers, doctors, and parents of individuals with dyslexia to begin using the intervention tools and strategies to increase the efficacy of reading participation in school-aged children. In fact, studies prove that integrating occupational therapy services into school curriculum leads to significant changes in emergent literacy functions, as well as fine motor skills (Bazyk et al., 2009). These significant improvements in these academic areas are effective in both school-aged children with and without disabilities (Bazyk et al., 2009). Furthermore, occupational therapy services prove to offer postsecondary success to students receiving the services and benefit functional abilities and health status (Eismann et al., 2017).

Attention-deficit/hyperactivity disorder and Occupational Therapy

The review of literature on occupational therapy's role in treating clients with ADHD showed relationships between ADHD, memory, and reading deficits. Multiple studies including Kofler et al. (2019) and Wangkawan et al. (2020), have found a connection between deficits in working memory of children who have been diagnosed with ADHD and reading deficits. There were multiple articles regarding interventions that have been studied to improve reading skills in children with ADHD. These interventions include music or background noises, therapy balls, and motivational interventions (Madjar et al., 2020; Taipalus et al., 2017; Zentall & Lee, 2012). It was also found that the cognitive-functional intervention, visuospatial working memory, and interactive metronome use were all effective ways for occupational therapists to work on reading deficits in children with ADHD (Kim et al., 2020; Shafer et al., 2001; Wangkawan et al., 2020).

However, several gaps in the research were found due to most of the studies being the first of their kind which created little reliability and validity.

Visual and Auditory Impairments and Occupational Therapy

Occupational therapy works with children that have visual and hearing impairment. Their role with addressing literacy is embedded in a team approach with this population. Children with either CVI (Cortical Visual Impairment) (cortical visual impairment; affecting areas of the brain that process visual information) or ocular impairment (affecting the eyes), benefit significantly from coordinated and comprehensive services to enable them to learn to use their remaining vision more efficiently and to learn nonvisual methods to complete activities (Warren & Nobels, 2016). Occupational therapy practitioners work as members of comprehensive rehabilitation teams to address development of gross and fine motor abilities, spatial awareness, and ADLs (Activities of Daily Living) such as feeding, toileting, dressing, and engaging in play, which depends upon a foundation of literacy (Warren & Nobles, 2016). Using this information, the practitioner can begin making goals and interventions to improve occupational function and participation.

Occupational therapy interventions used for hearing deficits often include augmentative alternative communication (AAC) devices. AAC therapy proves effective in increasing vocally produced words, proving beneficial for the school-aged participant of the study (Navarro et al., 2020). Occupational therapy also plays a part in the treatment of intellectual and developmental disabilities relating to vision and literacy. Treatment interventions for clients with autism spectrum disorder include interactive book reading and milieu teaching (Hudson et al., 2017; Julien & Reichie, 2016). Similarly, occupational therapy interventions have proven effective for school-aged youth with sensory processing disorders related to vision and hearing as well (Clark

et al., 2019). Another evidence-based intervention for school-aged youth with auditory processing disorder (APD) include the interactive metronome (IM), a computer-based assessment and treatment tool, which is proven to be effective in improving auditory temporal processing, language comprehension, reading, and attention (Chakraborty et al., 2017). Frequency modulation (FM) devices also assist children with APD with speech perception and recognition, which would improve academic outcomes, such as reading ability, as well (Reynold et al., 2016). Many OT interventions assist this population of children with the occupation of reading. Yoga has been found to increase educational participation, and creative activities, as well as interventions that involve parents and peers, work to increase literacy skills (Grajo et al., 2020). Therefore, occupational therapy has proven effective for children who have not been diagnosed with APD but have disorders that may cause auditory processing and reading deficits, such as sensory processing disorder or SPD.

Considering the importance of proficiency in all literacy skills on the ability of a child to participate successfully in occupations throughout the lifespan, it seems that OTs would play a greater role in intervening in all areas of literacy. There is a belief that occupational therapists in school settings are often seen as “handwriting therapists”, though their skills and education have prepared them for treating a wide array of different difficulties with literacy in children with various physical and mental disorders. The research team determined to use a scoping design to get a broader view of what occupational therapists are currently doing to work on all literacy skills with school-aged youth.

Methods

This scoping review utilized Arksey and O’Malley’s (2005) methodological framework to guide the research study. Compared to systematic reviews, which provide detailed summaries of all the available research in response to a well-defined research question obtained from a

narrow range of studies assessed by quality, a scoping review maps a broad area of research to provide a picture of the main emphases and gaps within a certain topic (Arksey & O'Malley, 2005). Arksey and O'Malley's (2005) methodological framework consists of five steps which will be used to answer the research question "What is the role of occupational therapy practitioners in school-aged youth literacy?" These steps consist of (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarizing, and reporting results (Arksey & O'Malley, 2005, p.22).

After reviewing related background information pertaining to the research question, a broad definition of operational definition of literacy was defined as the ability to use printed and written information to function in society. It also is used to achieve one's goals, and to develop one's knowledge and potential connects to the daily occupations that affect reading, learning, quality of life, and community integration (Francis & Beck, 2018). A second definition included "Literacy skills have been defined as reading, writing, speaking, and listening skills...There are four emergent literacy skills included: alphabet knowledge, phonological awareness, prink knowledge, and name writing" (Clark, 2016, p. 27-28). This definition also matched the American Occupational Therapy Association's definition of literacy includes several forms of expression: reading, writing, listening, and speaking" (AOTA, 2021). These definitions of literacy, in addition to the five steps proposed by the methodological framework of Arksey and O'Malley (2005) and the research question, guided the researchers towards obtaining and identifying relevant studies pertinent to the research question.

Identifying Relevant Studies

The researchers conducted searches for relevant articles pertaining to the research question from May 1, 2021 to September 3, 2021. With the guidance of a librarian and a research

advisor, the six databases of CINAHL, PubMed, Education Source, OVID, Educations Resources Information Center, and EBSCO Discovery Service were chosen to search.

The researchers used nine mesh terms. The following terms were used with the Boolean operator AND in conjunction with "occupational therapy, occupational therapist, occupational therapy assistant: phonological awareness, alphabet knowledge, print knowledge, name writing, literacy, pre-literacy, emergent literacy, early literacy, and school-aged youth." These mesh terms were based upon Clark's (2016) article "The Occupations of Literacy: Occupational Therapy's Role". Shawnee State University's blackboard site was utilized to organize and share articles with the researchers after the initial title and abstracts were screen. Blackboard is a password-protected online platform, which allows education to be delivered and developed by instructors to provide a user-friendly way to place course materials, interactive and/or collaborative activities, and assessments for students (The City University of New York, 2016).

Each researcher uploaded key articles to his or her respective discussion board tab named "Key Articles for Scoping Review" followed by each researcher's respective name. These respective tabs in the discussion board allowed for clear and easy organization of articles, which fit the criteria for the scoping review as well as identification of respective databases. Copies of these articles were also kept by each researcher's personal computer devices. A literature matrix using Microsoft Excel was shared between the researchers and research advisor via Google Drive to keep real-time updates on identification of relevant articles. Microsoft Excel is an electronic spreadsheet system based upon paper spreadsheets, which include tables made up of rows and columns to store related data (French, 2019).

Study Selection

The researchers of this scoping review independently screened titles and abstracts to identify articles that were related to the role of occupational therapy in school-aged youth

literacy. Questions used during the screening of titles and abstracts included: Does this article pertain to the role of occupational therapy practitioners or occupational therapy assistant practitioners in school-aged youth literacy? Does this article answer what role the occupational therapist, occupational therapy assistant, or occupational therapy profession plays concerning children and school-aged literacy? Does this article reveal information pertaining to the roles, responsibilities, and duties occupational therapists or occupational therapy assistants take when addressing literacy and school-aged youth?

Inclusion criteria for the study included peer reviewed journal articles written in English, ~~and occurred~~ national or international articles, the ability for researchers to obtain the full text of the article. Also, inclusion criteria included studies that stated occupational therapist(s) or occupational therapy assistant(s) as an author or an active contributor in the role of school-aged literacy (K-12 grade), and articles published within the publication range of 1975 to the present time. The types of studies included for the scoping review were randomized controlled trials, descriptive studies, intervention studies, and qualitative studies. Systematic reviews and literature reviews were eliminated from the review process except for secondary review of their references for articles that were not located through the seventh-database search.

Articles that did not include information about the four literacy skills of reading, writing, speaking, and listening and articles with emphasis on early intervention (birth to 3 years old), preschool, or adult populations (Twelfth grade and older) were excluded from the scoping review. No date limit was set for researchers to discontinue searching for relevant articles to ensure full exploration of searching was complete.

Table 1

Inclusion and Exclusion Criteria of the Scoping Review and Operational Definitions of Literacy

Inclusion Criteria	Exclusion Criteria

• Peer-Reviewed Journals • Written in English • Study occurs nationally or internationally • Includes terms: "Occupational Therapy/Occupational Therapist/or Occupational Therapy Assistant" • School-Aged Children (K-12) • Publication Range: Years 1975 (IDEA Public Law 94-142 was signed)-Present • Access to full text of article	• Articles which did not include information about the four literacy skills (reading, writing, speaking, listening) • Articles with emphasis on early intervention (birth to 3 years old), preschool, or adult population (Twelfth grade and older)
Operational Definitions of Literacy	
• "Literacy includes several forms of expression: reading, writing, listening, and speaking" (AOTA, 2021). • "Literacy skills have been defined as reading, writing, speaking, and listening skills...There are four emergent literacy skills included: alphabet knowledge, phonological awareness, print knowledge, and name writing" (Clark, 2016, p. 27-28).	

As the researchers screened and selected appropriate research articles, they met weekly through the virtual platform of Zoom to discuss the search process and determine if changes in the search strategies were necessary. The search strategy was enhanced through hand searching the original articles references for additional articles that met the inclusion and exclusion criteria. Hand searching was performed twice, once on the original articles and a second time on the first set of hand-searched articles.

Three hundred and eleven articles were selected by researchers to be introduced into the final selection process. The final selection of articles from the screening process was determined through the researchers reading the full text of the articles and ensuring each met the inclusion criteria. After the final selection and screening process, twenty-two articles were found to have met the inclusion criteria. The first round of hand-searched articles from these original articles

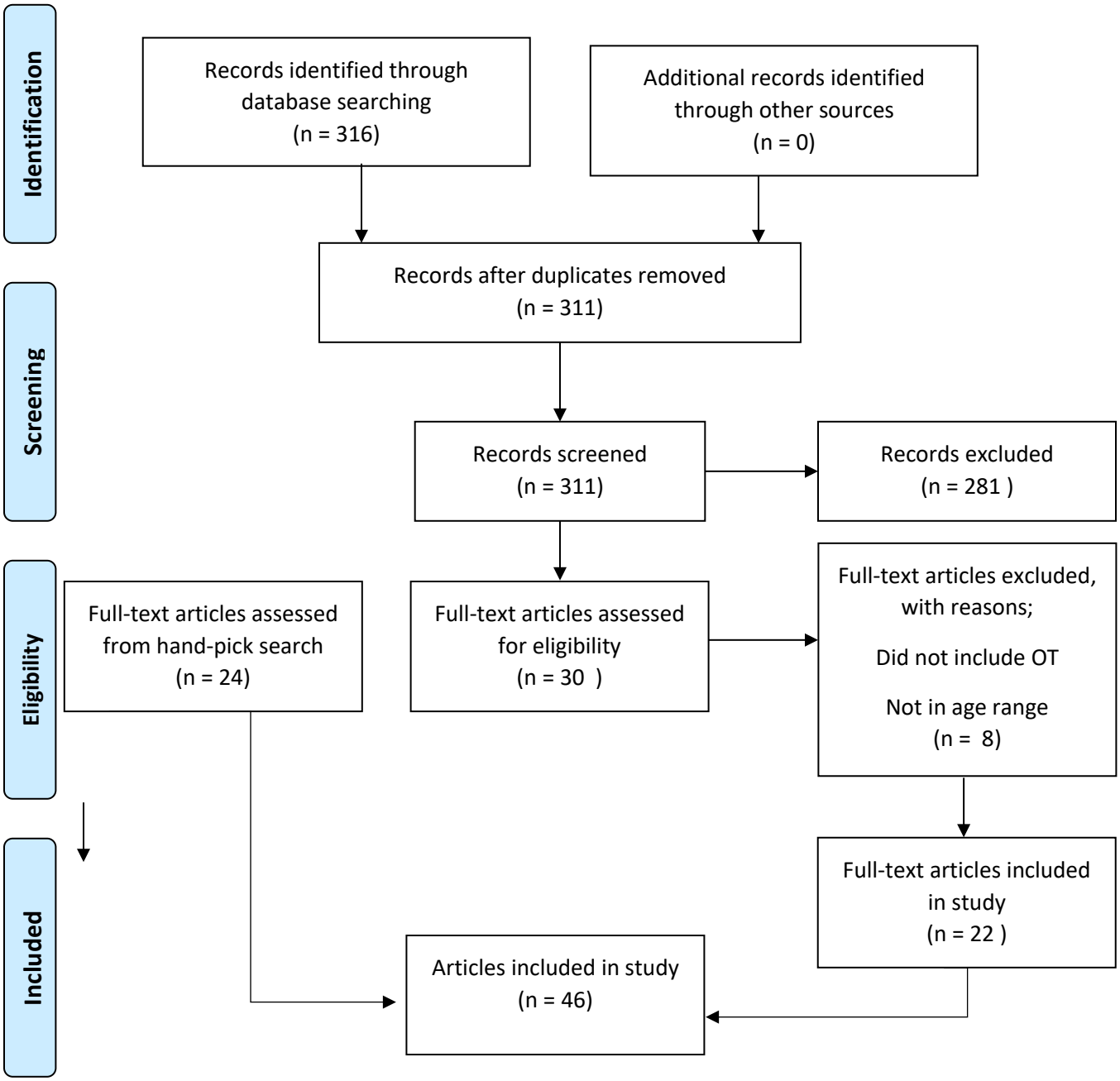
totaled twenty-two articles. The second round of hand-searched articles from the first round of hand-searched articles totaled two. Forty-six articles were totaled through the final selection processes and hand-searched articles were found to meet inclusion criteria, not including the five duplicates found between the researchers.

Instrumentation

Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al. 2009), an outline and flow diagram of the included and excluded articles at each phase is presented in figure 1. The flow diagram visually demonstrates the search process and recorded number of articles explained above as well as the excluded number of articles at each stage.

Figure 1

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)



Note. PRISMA diagram of article selection into scoping review for determination of the role of occupational therapy in school-age youth literacy. From "Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement," by D. Moher, A. Liberati, J. Tetzlaff, D. G. Altman, and The PRISMA Group, 2009, PLoS Med, 6(6), e1000097

Charting Data

Arksey & O'Malley (2005) describes 'charting the data' by utilizing the definition from Rickie and Spencer (1994), which is, "A technique for synthesizing and interpreting qualitative data by sifting, charting, and sorting material according to key issues and themes" (p. 26). To chart the data, researchers used Garrard's (2017) literature matrix method. This matrix method is a structure for processing and reviewing literature. The research team used the program Excel, which could be accessed and edited by all team members using Microsoft OneDrive. This resulted in a review matrix as a spreadsheet with columns and rows that were used to extract data from each journal article.

The data charting form or review matrix included the following information: author(s), publication date, article title, journal title, keywords or MeSH terms, purpose/research question(s), design, number of participants, sample characteristics, instrument(s) used, results, conclusions, relevance to research topic, comments/questions, APA reference, and DOI. To ensure consistency and reliability, the researchers reviewed two predetermined articles independently of each other, using the previously mentioned categories of the matrix. After the researchers independently reviewed the articles and extracted the data, the researchers met to review each matrix entry and discussed any discrepancies. Using the second article, the inter-rater reliability was calculated at 89%.

Collating, Summarizing, and Reporting the Results

In the collating, summarizing, and reporting the results stage of the scoping review, the researchers seek to present an overall picture of all articles and materials reviewed. Therefore, issues pertaining to how to present the large amount of material are critical (Arksey & O'Malley, 2005). Unlike a systematic review, the scoping study does not have a goal of synthesizing or

accumulating results of different studies. Thematic analysis was conducted using the review process outlined by Braun and Clarke (2006). The first phase is for the researchers to familiarize themselves with the data in the articles by reading through them. In phase two, the researchers categorized interventions and predicted trends using the review matrix to extract the approaches used by occupational therapists. In phase three, the researchers analyzed the data found to investigate the role of occupational therapy in literacy for school aged youth. Validity of peer-reviewed themes was assessed within the final 46 articles with verification of themes extracted by two separate research members. If there was a discrepancy, it was discussed by all research members and the research advisor to assess the data and come to a final agreement on the discrepancy. Lastly, in stages four and five, the researchers described the implications and findings for practice. Utilizing this process by Braun and Clarke (2006) gave the researchers a clear understanding of the themes presented in the articles and aided in the identifying of gaps in the current research.

Results

Year of Article Publication

Forty-six peer reviewed journal articles met the inclusion criteria and were reviewed for analysis for this scoping review. These forty-six articles were published over a period of 46 years. Researchers included articles from 1975-2021 for this study. No articles were included from the years 1975-1989. Seventy-nine percent of the articles range from 2006-2021. An accurate representation of articles found in each range of years can be found in Figure 3 below.

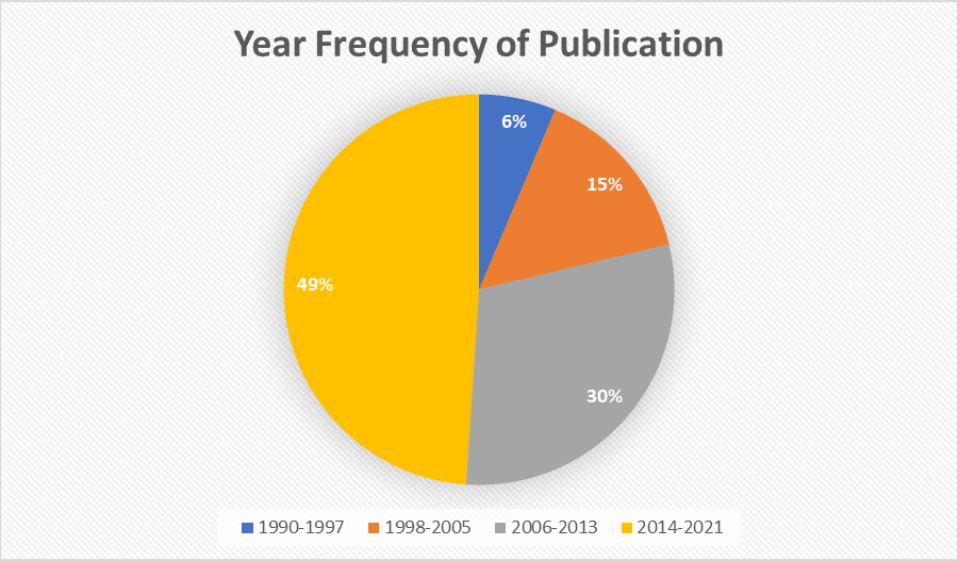


Figure 3 demonstrates the frequency of articles by specific periods.

Age of Population Receiving Therapy

Per the inclusion criteria of the study, school-age criteria were specific to grades kindergarten to twelfth grade. Three articles had been excluded-due to the ages ranging from birth to three and preschool aged children. The forty-six articles that were included in the study were further screened for age of the population (or grade), what literacy skills were being addressed by the occupational therapist typical children or children with a diagnosis, instruments/assessments used in relation to literacy. Figure 4 represents the frequency of ages and grades that were found in the articles in which occupational therapists addressed literacy skills in their therapeutic interventions.

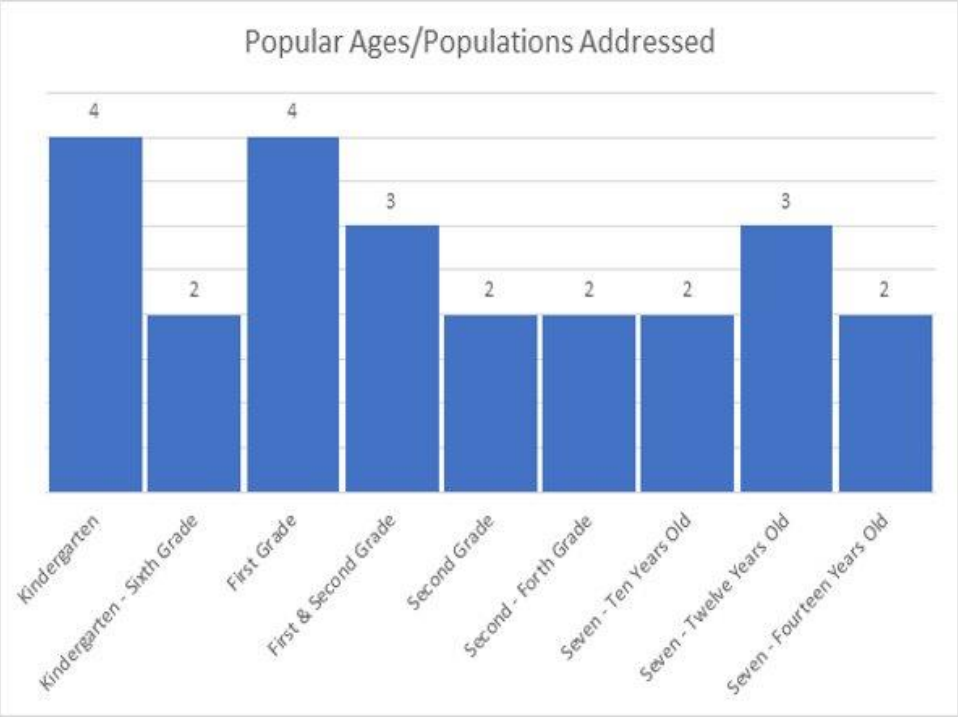


Figure 4 represents the frequency of ages and grades

Literacy Skills Being Addressed

The following nine search terms were occupational therapy, occupational therapist, occupational therapy assistant: phonological awareness, alphabet knowledge, print knowledge, name writing, literacy, pre-literacy, emergent literacy, early literacy, and school-aged youth. Once the forty-seven articles were screened and deemed eligible, researchers selected common search terms to guide the results of this study. Common terms included phonological awareness, emergent literacy, auditory, name writing, memory, alphabet knowledge, attention, early literacy, print knowledge, cognition, vision, and perception. Figure 5 shows an accurate representation of the number of articles that address each literacy topic. It was common for each article to address more than one topic.

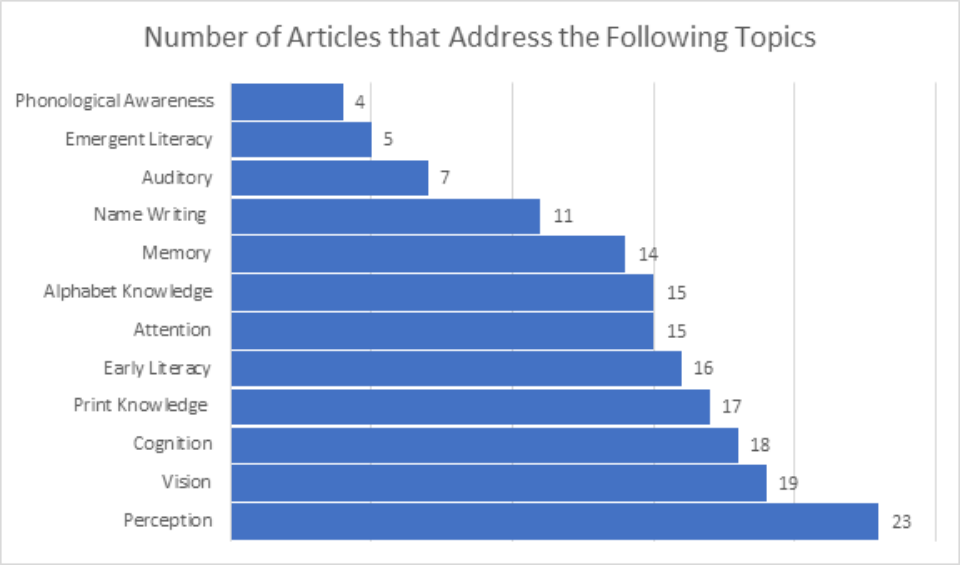


Figure 5 demonstrates the number of articles that address literacy topics

Socioeconomic Status

Of the forty-six articles, nine articles stated the socioeconomic status of the participants. Thirty-seven of the articles included did not state the socioeconomic status at the time of this study. Figure 6 represents the percentage of articles that included children in a low socioeconomic status, a various status, or if the study did not mention the socioeconomic status. Various socioeconomic status means that the study included participants from low, middle, and high socioeconomic backgrounds.

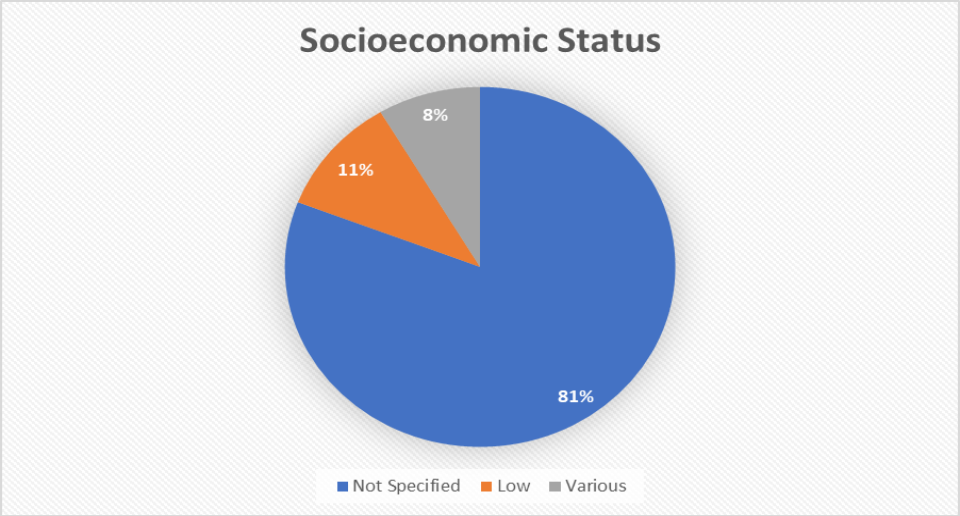


Figure 6 demonstrates the socioeconomic background of participants included in each study.

Diagnosis

When a child is developing typically, this means that the child is average with his/her peers while when a child is considered atypical, this means that the child is not developing at the current rate as his/her peers. When a child is atypical, the child may or may not have been given a diagnosis. For this study, researchers reviewed the included forty-nine articles and determined if the studies participants were labeled as typical, atypical, or if the school-aged children had a diagnosis. As seen in Figure 7, of the forty-nine articles eighteen articles recruited typical children, ten articles recruited children considered atypical, seven articles addressed specific diagnosis, six articles addressed both typical and atypical children, two articles did not specify the population, and three articles did not address children directly.

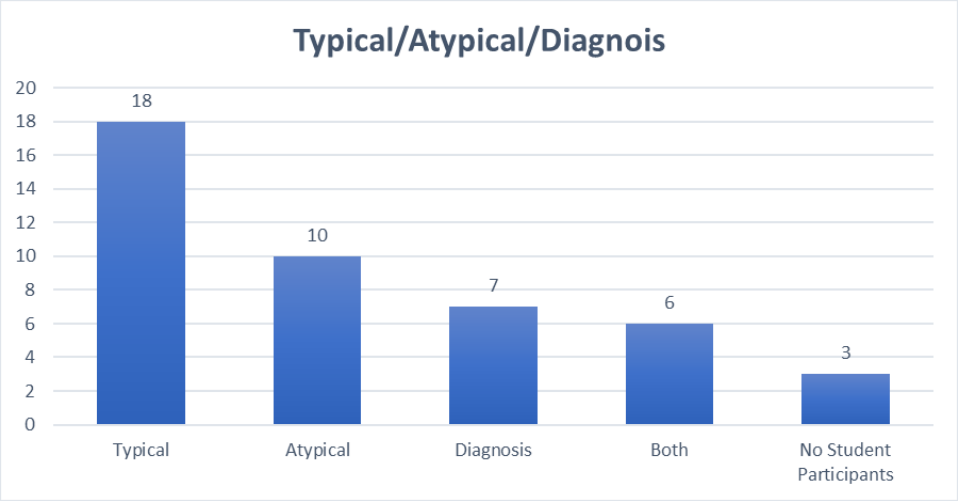


Figure 7 – Articles that address typical, atypical, or children with a diagnosis.

Type of School

The studies that were included presented participants from different areas and practice types. To be included in the study, participants had to fit the criteria of school aged youth. One study recruited participants from an outpatient office where the children were already receiving services. Participants that were enrolled in a public school were included in 24 of the included

studies. This is the largest recruitment area shown. Participants that were recruited from private schools were included in four studies. One study in particular recruited participant from both public and private schools. Figure 8 below shows school types in which participants were recruited from.

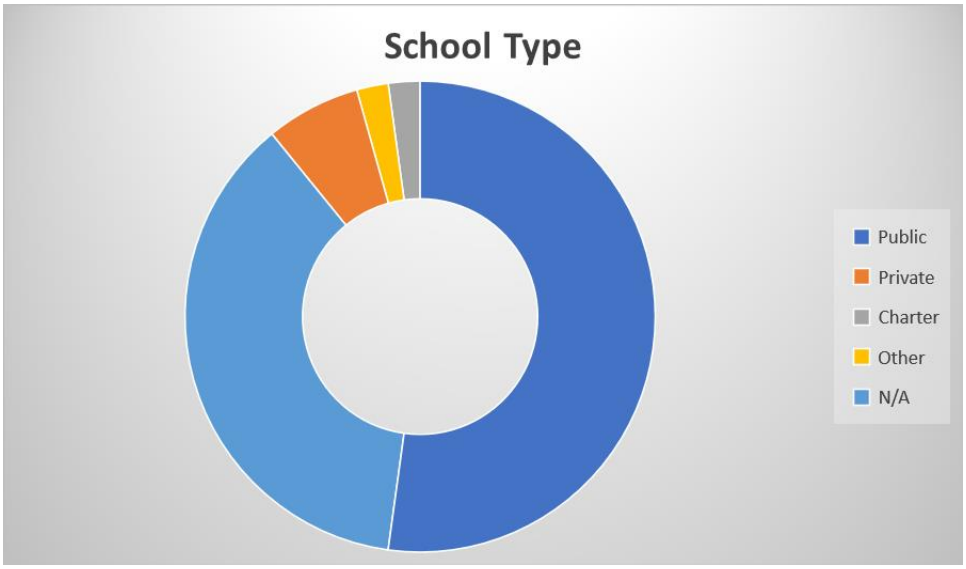


Figure 8 – School Types in which participants were recruited from.

Location of Study

Included studies gathered information from several locations in the United States as well as international locations. United States locations included the states of Ohio, Illinois, Washington, New York, and Texas. Other locations in the U.S. also included areas from the southeast, northeast, and the Midwest. International locations included studies from Brazil, the United Kingdom, India, Ireland, New Zealand, Australia, Canada, Japan, and Switzerland. An accurate number of articles located in both the United States or in international locations are shown in figure 10.

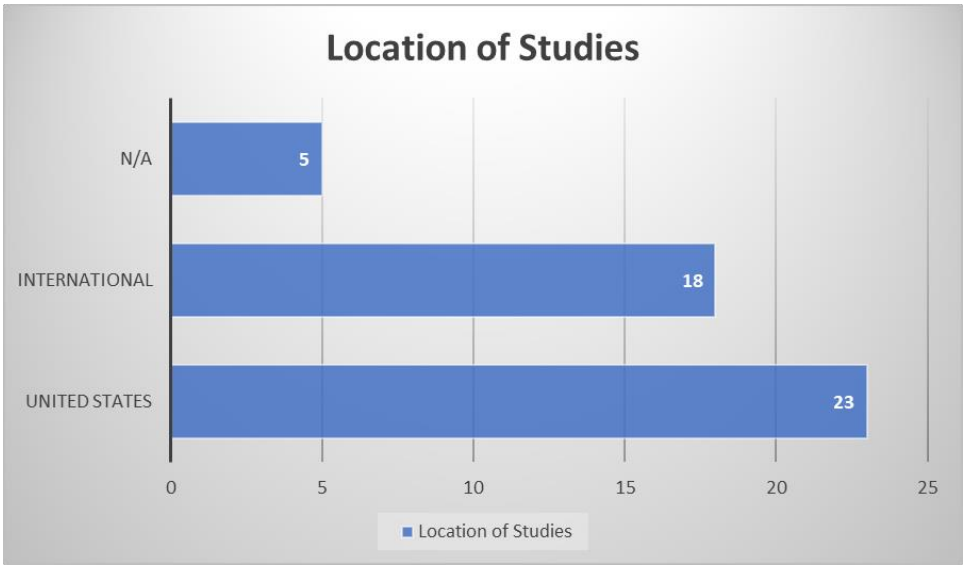


Figure 10 – Location of the included studies.

Participants Receiving Services

Of the forty-six articles included, twenty-three stated that the participants that were included in the study were already receiving services. Occupational therapists, physical therapists, speech language pathologists, and audiologists provided services. It is important to note that one article mentioned that the participants were not receiving services at the start of the research study but were referred to services after the research had been conducted. For this study, this specific article was placed in the category of not receiving services since the services were not provided prior to the start of the research.

Assessments

Many assessments were noted within the 46 articles due to the various professions that focused on literacy with this population. As noted in Table 2, the highest number of articles that included the same assessment was used by OT and measured handwriting skills. Five articles referenced the Evaluation of Children's Handwriting Test and five articles referenced the Minnesota Test of Handwriting. Forty-six assessments were only referenced one time in the articles.

Table 2

ASSESSMENT	OT	SPEECH	AUDIOLOGIST	EDUCATOR	# ARTICLES
Frequency Pattern Test		Y	Y		1
Gap in Noise Test		Y	Y		1
Auditory and Visual Attention Tests		Y	Y		1
Visual digit span		Y	Y		2
Word imitation tasks		Y			1
Lindamood Auditory Conceptualization Test		Y	Y		1
The British Abilities Scales (BAS II)				Y	2
Three subtests of Clay's (1993) Observation Survey of Early Literacy Achievement (OSELA)				Y	2
Fine Motor (FM) scale of the Peabody Developmental Motor Scales–2 (PDMS–2)	Y				2
PDMS-2 Grasping and Visual–Motor Integration that measure hand use, eye–hand coordination, and manual dexterity	Y				1
Nine-hole peg board	Y				2
The Printing Tool ®	Y				1
Fountas and Pinnell Benchmark Assessment System				Y	1
Dynamic Indicators of Basic Early Literacy Skills				Y	1
Dolch Sight Word List		Y	Y		1
Test of Word Reading Efficiency		Y	Y	Y	1
Reading Occupations and Habits Questionnaire	Y				1
Evaluation of Children's Handwriting Test	Y				5

Minnesota Handwriting Assessment	Y				5
Woodcock-Johnson Fluency and Writing Samples Test				Y	2
Modified Handwriting Without Tears Print Tool.	Y				1
Beery-Buktenica Developmental Test of Visual Motor Integration	Y				3
Test of Handwriting Skills Revised (THS-R)	Y				3
3 subtests of the Developmental Test of Visual Perception	Y				1
Bruininks-Oseretsky Test of Motor Proficiency (BOT-2)	Y				1
School Function Assessment	Y				2
Canadian Occupational Performance Measure (COPM)	Y				1
Teacher Awareness Scale (TAS)				Y	1
The Fine Motor Quotient/ PDMS-2 OR BOT-2	Y				1
Visual–Motor Integration test	Y				1
Translation test				Y	1
Wechsler Adult Intelligence Scale (WAIS)				Y	1
Snellen chart					1
RAF Binocular gauge					1
Castles and Coltheart's irregular and non-word lists				Y	1
Child Sensory Profile-2	Y				1
Dyslexia Screening Test-Junior				Y	1

North Dakota Title I Kindergarten Reading Standards Assessment (Letter Identification Subtest)				Y	1
Developmental Test of Visual Perception (DTVP-2)	Y				3
Test of Manual Pointing (TMP)	Y				1
In-Hand Manipulation (IHM)	Y				
Pediatric Overall Performance Category					1
Pediatric Cerebral Performance Category	Y				1
Modified Glasgow Outcome					1
Vineland Adaptive Behavior Scales	Y			Y	1
Functional Status Scale					1
Visuospatial working memory assessment (VWMA)		Y	Y		1
teacher Self Report Questionnaire (internally developed by authors)				Y	1
Brief Assessment Tool for Handwriting (BATH)	Y				1
Movement Assessment Battery for Children (M-ABC)	Y				1
M-ABC Parent Checklist	Y				1
Kaufman Brief Intelligence Test (K-BIT)				Y	1
Developmental Test of Visual-Motor Integration (DVMI)	Y				3
Scale of Children's Readiness in Printing (SCRIPT).	Y				1

Arizona Articulation Proficiency Scale-Second Edition		Y	Y		1
Vineland Adaptive Behavior Scales-Classroom Edition	Y			Y	1
Client Satisfaction Questionnaire					1
School-Based Intervention and Communication Questionnaire		Y			1
Motor Accuracy Test (MAC)		Y			1
The Concise Assessment Scale for Children's Handwriting (BHK)		Y			2
the section "Manual Dexterity" of the Movement Assessment Battery for Children (M-ABC) REPEAT	Y				1

Discussion

Several themes emerged that answered the research question from the results of this study. Many of these themes first appeared during the background work determining the direction of the study. These including the four literacy skills (alphabet knowledge, print knowledge, name writing, and phonological awareness), demographic themes related to the participants of each study (location, school type, age, etc.), and the types of interventions and assessments used by occupational therapists in each study. Through these themes, trends occurred for assessments administered, interventions used, and how demographic factors (such as socioeconomic status, location, and age) influenced the services that a child with literacy skill deficits was able to receive.

How Our Findings Relate to Previous Literature

Our findings relate to the previous literature on the topic of the role occupational therapists play in working with school-aged youth on their literacy skills in several ways. First, the studies we reviewed were mostly concerned with evaluating or intervening in handwriting skills. In fact, of the four emerging literacy skills that were used as search terms for this study, print knowledge was the term most often included in the articles, as this skill was included in seventeen of the forty-seven articles. Many of the assessments and interventions found within the articles also measured or worked to improve handwriting skills. For example, the Minnesota Handwriting Assessment and the Evaluation Tool of Children's Handwriting Manuscript were each used as outcome measures in five of the articles evaluated for this study. The Minnesota Handwriting Assessment was published in 1999 and was developed to evaluate handwriting skills in first and second grade students. The Evaluation Tool of Children's Handwriting Manuscript is a criterion-referenced tool used to assess legibility and speed of handwriting in children in first through sixth grade. The previous research completed by Feder et al. (2000) confirms that there has been a long-held notion that occupational therapists tend to be seen as "handwriting therapists". In fact, according to Feder et al. (2000), "Handwriting and related fine motor problems are a primary reason for referral to occupational therapy, particularly in the school setting" (p. 198).

Though our findings certainly indicated that handwriting interventions are a common way in which occupational therapists address literacy skills with children on their caseload, there are indications that the profession is beginning to expand their role addressing literacy. Though many of the selected articles discussed top-down approaches that directly address literacy skills such as reading and handwriting, there were several articles that took a bottom-up approach to therapy. In bottom-up approaches, client factors such as fine motor skills, visual perception, and in-hand manipulation, are treated to improve performance in desired occupations. These bottom-

up approaches included auditory sensory training (Murphy et al., 2015a; Murphy et al., 2015b), use of colored filters (Harries et al., 2015; Hall et al., 2013), use of stability balls (Fedewa et al., 2015; Schilling et al., 2003), fine/gross motor interventions (Wehrmann et al., 2005; Reid et al., 2006; Bayzk et al., 2009), and interventions addressing visual perception. Many of the studies found that measured bottom-up skills, such as visual perception, attention, and memory, were recent studies that evaluated public school children.

Though handwriting assessments were the most commonly used outcome measures throughout the articles, skills such as perception, vision, and cognition were the most common themes discussed throughout the articles. Cognition was considered as a group of skills including executive functioning (emotional regulation, decision-making, self-control, etc.), memory, and attention. However, many educational professionals evaluate and treat cognitive occupational therapists address cognition by evaluating underlying factors (ie, visual scanning, executive functioning, etc. to guide interventions for literacy. Examples of underlying factors addressed by occupational auditory and visual attention testing (Murphy et al., 2005b), were the use of stability balls (Fedewa et al., 2015; Schilling et al., 2003), educational strategies on sustaining attention while reading (Arnaud & Gutman, 2016), and direct observation of attention (Asher & Nichols, 2016; Zachry et al., 2020). Addition strategies were teaching self-monitoring strategies (Lee & Lape, 2020), use of DRT filters while reading (Hall et al., 2013), use of current models of attentional networks (Armstrong-Gallegos & Nicolson, 2020), and use of the Visuospatial Working memory Assessment (VWMA) (Wankawan et al., 2020). Many of the assessments for attention discussed throughout the articles were administered either fully or in part by an audiologist, which demonstrates the importance of collaboration between professionals when addressing complex needs such as lack of auditory or visual attention.

Results indicated a collaborative model between professionals to determine what could be hindering literacy achievement. However, occupational therapists have training in completing various vision, auditory, and speech related assessments, collaboration with speech language pathologists (SLPs), audiologists, and educators can be helpful to determine a child's strengths and weakness'. Collaboration between OTs, SLPs, and audiologists was exemplified having each discipline assess and then come together to give a global look of a child. According to Benson (2013) and Kennedy & Stewart (2011), collaboration between educators and OTs has shown to encourage positive student outcomes and improve overall student performance. Reynolds et al. (2016), states that occupational therapy practitioners are encouraged to work with a wide variety of professionals including audiologists, SLPs, educators, and other team members in order to properly assess clients and implement necessary interventions and adaptive equipment. With the broadening of OTs expertise beyond handwriting identified in the literature, it is important to educate others how OTs can contribute to the collaboration.

Finally, our research relates to previous research because the articles confirmed that early elementary intervention is a critical time to address literacy skills. According to Feder et al. (2000), "Handwriting can be viewed as an occupational performance for the school-aged child in that it is an expected skill necessary for functioning in a mainstream classroom environment" (p. 198). Our research shows that most occupational therapy intervention and assessment concerning literacy takes place between kindergarten and second grade. In fact, only two studies included children that were older than elementary age, and these studies focused on the Handwriting Without Tears Program (6) and handwriting speed interventions (44).

Alternate Explanations

Though this study has enabled us to have a greater understanding of the role occupational therapists are playing in the intervention of literacy skills in school-aged youth, there are

alternative explanations that could also explain the results of this study. First, we were limited to searching specific databases, which means that we may have missed some information that is available on how occupational therapists are currently evaluating literacy skills and treating literacy deficits with children on their caseload. If it had been possible to search through all the databases available to us, we may have found more data that supported or refuted various assessments or intervention practices that were commonly used in the articles located. Even if we were able to search each database and find every article related to this topic, this still may not accurately reflect what is currently happening in clinical practice. Many occupational therapists have tried true methods for working with children on their handwriting and reading skills, as well as the underlying skills required for these tasks, that may never be published in a research article. Finally, many of the articles included in this study focused on specific areas of the United States and Australia, which makes it difficult to know which assessments and interventions are being used in other parts of the United States and the world.

How Our Findings Relate to Previous Literature and Alternate Explanations

Pediatric OTs have been known as handwriting therapists, which was also identified in this study. Occupational therapy has an unique set of skills that evaluate and treat the whole child (cite). Therapist exam the occupation of literacy, body functions that are needed for literacy, and how the environment affords or hinders the child's ability. The emergence of new evaluation tools and interventions for literacy skills reflect that therapists understand literacy deficits is not a one size fits all approach and the role of OTs on the team is broader than just handwriting. There were few interventions that had more than two studies dedicated to their effectiveness. Even though this study did not involve evaluating the strength of the studies, the limited number of articles that were designed to measure effectiveness were minimal.

Limitations

There were several limitations present in this scoping study. First, the researchers were limited to specific databases that were available to them as students at Shawnee State University. Of the databases that were available, only six were searched for this study. Broader Mesh terms may have resulted in more articles describing occupational therapists role working on literacy with the pediatric population. Finally, though international articles were included, only articles written in English was selected as part of our inclusion criteria, which limited the information retrieved for an accurate global perspective.

Future Research

Based on the results of this scoping review, several future studies could further the understanding of the relationship that occupational therapy has with the assessment and intervention of literacy skills in school-aged youth. Since many of the articles focused on children in elementary school, it would be insightful know how occupational therapists are remediating literacy deficits with children in middle and high school. It would also be of interest to research the ways in which occupational therapists could work with children in the years before they begin formal education to provide literacy-based enrichment. Since we found several articles that discussed the connection between auditory perception and literacy skills, it would be beneficial to have a greater understanding of how OTs could work with other medical professionals, such as audiologists, to improve the literacy skills. Sound-based intervention is a more recent area of practice that OTs are using, but research needs to explore if this has a positive impact on literacy (Frick, 2020). Finally, it would be beneficial to our profession to have more research regarding the occupations of reading, especially from a top-down approach.

Conclusion

This scoping review suggests the role of occupational therapy practitioners in school-aged youth literacy is represented by four emergent literacy skills: phonological awareness, name writing, alphabet knowledge, and print knowledge. However, this research study found limited evidence on the use of phonological awareness interventions within the scope of occupational therapy practice compared to the other three emergent literacy skills. The remaining three emergent literacy skills also corresponded with a large number of handwriting interventions and handwriting assessments used by the profession of occupational therapy. Additionally, the past two decades have shown a significant increase in the role of occupational therapists addressing school-aged youth's literacy needs. Lastly, occupational therapists are beginning to branch out to identify literacy skills related to cognitive skills and perception as well as increasing collaboration with other professions, which warrants continued study.

References

American Occupational Therapy Association. (2014). *Occupational therapy's role with school settings*. https://www.aota.org/-/media/Corporate/Files/AboutOT/Professionals/WhatIsOT/CY/Fact-Sheets/School%20Settings%20fact%20sheet.pdf.

American Occupational Therapy Association. (2020). Occupational therapy practice framework: Domain and process (4th ed.). *American Journal of Occupational Therapy*, *74*(Suppl. 2), Article 7412410010. https://doi.org/10.5014/ajot.2020.74S2001

American Occupational Therapy Association. (2021). *Literacy.* https://www.aota.org/Practice/Children-Youth/literacy.aspx

Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, *8*(1), 19–32. https://doi-org.10.1080/1364557032000119616

Armstrong-Gallegos, S., & Nicolson, R. I. (2020). Problems in audiovisual filtering for children with special educational needs. *I-Perception.* https://doi.org/10.1177/2041669520951816

Arnaud L. M., & Gutman S. A. (2020) Effectiveness of an occupational therapy reading program for low socioeconomic first and second graders in an urban elementary school: A pilot randomized controlled study. *Journal of Occupational Therapy, Schools, & Early Intervention, 13*(3), 302-319. https://doi.org/10.1080/19411243.2020.1732260

Asher, A. & Nichols, J. (2016). Collaboration around facilitating emergent literacy: Role of occupational therapy. *Journal of Occupational Therapy, Schools, & Early Intervention, 9*(1), 51-73.

Ayres, A. J. (1972). *Sensory integration and learning disorders*. Western Psychological Services.

Bazyk, S., Michaud, P., Goodman, G., Papp, P., Hawkins, E., & Welch, M. A. (2009). Integrating occupational therapy services in a kindergarten curriculum: A look at the outcomes. *American Journal of Occupational Therapy, 63*(2), 160–171. https://doi.org/10.5014/ajot.63.2.160

Benson, J. (2013) School-based occupational therapy practice: Perceptions and realities of current practice and the role of occupation. *Journal of Occupational Therapy, Schools, and Early Intervention, 2*(6), 165-178. https://doi.org/10.1080/19411243.2013.811348

Braun, V., & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Case-Smith, J. Holland, T., & Bishop, B. (2011). Effectiveness of an integrated handwriting program for first-grade students: A pilot study. *American Journal of Occupational Therapy,* 65, 670-678. doi: 10.5014/ajot.2011.000984

Chakraborty, S., Kaf, W., & Lucker, J. R. (2017). Interactive metronome: Research review related to treating auditory processing disorders in children. *Journal of the Academy of Rehabilitative Audiology, 50*, 28–35.

Chandler, B. (1994, December 15). The power of information: School based practice survey results, *OT Week, 18*, 24.

Clark, G. F. (2016). The occupations of literacy: Occupational therapy's role. *Journal of Occupational Therapy, Schools & Early Intervention*, *9*(1), 27–37. http://doi.org/10.1080/19411243.2016.1152835

Clark, G.F., Watling, R., Parham, D., & Schaaf, R. (2019). Occupational therapy interventions for children and youth with challenges in sensory integration and sensory processing: A

school-based practice case example. *The American Journal of Occupational Therapy*. https://doi.org/10.5014/ajot.2019.733001

Dunst, C. J., Trivette, C. M., Masiello, T., Roper, N., & Robyak, A. (2006). Framework for developing evidence-based early literacy learning practices. *CELL papers*, *1*(1), 1-12.

Eismann, M. M., Weisshaar, R., Capretta, C., Cleary, D. S., Kirby, A. V., & Persch, A. C. (2017). Characteristics of students receiving occupational therapy services in transition and factors related to postsecondary success. *The American Journal of Occupational Therapy*, *71*(3), doi: 10.5014/ajot.2017.024927

Feder, K., Majnemer, A., & Synnes, A. (2000). Handwriting: Current trends in occupational therapy practice. *Canadian Journal of Occupational Therapy*, *67*(3), 197–204. https://doi.org/10.1177/000841740006700313

Fedewa, A., Davis, M. A. C., & Ahn, S. (2015). Effects of stability balls on children's on-task behavior, academic achievement, and discipline referrals: A randomized controlled trial. *American Journal of Occupational Therapy*, *69*(2), 1–9. https://doi.10.5014/ajot.2015.014829

Francis, T., & Beck, C. (2018). Visual motor integration for building literacy: The role of occupational therapy. *OT Practice 23(*15), 14–18.

French, T. (2019). *Learn what ms excel does plus*. Lifewire. https://www.lifewire.com/what-is-microsoft-excel-3573533.

Frick, S. (2020). *Therapeutic listening.* In A. C. Bundy & S. J. Lane (Ed.), Sensory integration: Theory and practice (3rd ed., pp., 462-465). Philidelphia: F. A. Davis Co.

Garrard, J., (2017). *Health sciences literature review made easy: The matrix method.* Aspen Publishers.

Grajo, L. & Candler, C. (2018). The clinical and classroom utility of the inventory of reading occupations: An assessment tool of children's reading participation. *Open Journal of Occupational Therapy*, *6*(2), 1–10. https://doi.org/10.15453/2168-6408.1440

Grajo, L. C., Candler, C., Bowyer, P., Schultz, S., Thomson, J., & Fong, K. (2016). Determining the internal validity of the inventory of reading occupations: An assessment tool of children's reading participation. *American Journal of Occupational Therapy*, *70*(3), 1-2. https://doi.org/10.15453/2168-6408.1440

Grajo, L. C., Candler, C., & Sarafian, A. (2020). Interventions within the scope of occupational therapy to improve children's academic participation: A systematic review. *American Journal of Occupational Therapy*, *74*(2). https://doi.org/10.5014/ajot.2020.039016

Hall, R., Ray, N., Harries, P., & Stein, J. (2013). A comparison of two-coloured filter systems for treating visual reading difficulties. *Disability and Rehabilitation*, *35*(26), 2221–2226. https://doi.org/10.3109/09638288.2013.774440

Hanser, G. (2010). Emergent literacy for children with disabilities. *OT Practice*, 15(3), 16-20. https://doi/10.105132338

Harries, P., Hall, R., Ray, N., & Stein, J. (2015). Using coloured filters to reduce the symptoms of visual stress in children with reading delay. *Scandinavian Journal of Occupational Therapy*, *22*(2), 153–160. https://doi.org/10.3109/11038128.2014.989903

Hernandez, D. J. (2011). Double jeopardy: How third grade reading skills and poverty influence high school graduation. Baltimore: Annie E. Casey Foundation. http://files.eric.ed.gov/fulltext/ED518818.pdf

Hudson, R. F., Sanders, E. A., Greenway, R., Xie, S., Smith, M., Gasamis, C., Martini, J., Schwartz, I., & Hackett, J. (2017). Effects of emergent literacy interventions for

preschoolers with autism spectrum disorder. *Exceptional Children, 84*(1), 55–75. https://journals.sagepub.com/doi/10.1177/0014402917705855

Iyer, S., Gahagan, S., Do, D., Akshoomoff, N., Malcarne, V. L., Hattrup, K., Berger, S. P., & Needlman, R. (2019). Development of a brief screening tool for early literacy skills in preschool children. *Academic Pediatrics, 19*(4), 464–470. doi:10.1016/j.acap.2018.11.008

Julien, H. M., Reichle, J., Nippold, M., & Proctor-Williams, K. (2016). A comparison of high and low dosages of a component of milieu teaching strategies for two preschool-age learners with autism spectrum disorder. *Language, Speech & Hearing Services in Schools, 47*(1), 87–98. https://doi.org/10.1044/2015_LSHSS-15-0035

Kennedy, S., & Stewart, H. (2011). Collaboration between occupational therapists and teachers: Definitions, implementation and efficacy. *Australian Occupational Therapy Journal, 58*(3), 209-214. https://doi.org/10.1111/j.1440-1630.2011.00934.

Kofler, M. J., Spiegel, J. A., Soto, E. F., Irwin, L. N., Wells, E. L., & Austin, K. E. (2019). Do working memory deficits underlie reading problems in attention-deficit/hyperactivity disorder (ADHD)? *Journal of Abnormal Child Psychology, 47*(3), 433–446. https://doi.org/10.1007/s10802-018-0447-1

Lee, A. & Lape, J. (2020). A cognitive, self-monitoring intervention for handwriting with second-grade students. *Journal of Occupational Therapy, Schools, and Early Intervention, 13*(2), 170-185. https://doi.org/10.1080/19411243.2019.1672604

Madjar, N., Gazoli, R., Manor, I., & Shoval, G. (2020). Contrasting effects of music on reading comprehension in preadolescents with and without ADHD. *Psychiatry Research, 291*, 1-8. https://doi.org/10.1016/j.psychres.2020.113207

Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLOS Medicine 6*(7), e1000097. https://doi.org/10.1371/journal.pmed.1000097

Murphy, C. F., Moore, D. R., & Schochat, E. (2015). Generalization of auditory sensory and cognitive learning in typically developing children. *PloS one, 10*(8). https://doi.org/10.1371/journal.pone.0135422

Murphy, C. F., Pagan-Neves, L. O., Wertzner, H. F., & Schochat, E. (2015). Children with speech sound disorder: Comparing a non-linguistic auditory approach with a phonological intervention approach to improve phonological skills. *Frontiers in Psychology,* 6, 64. https://doi.org/10.1080/19411243.2019.1672604

Navarro, I. I., Cretcher, S. R., McCarron, A. R., Figueroa, C., & Alt, M. (2020). Using AAC to unlock communicative potential in late-talking toddlers. *Journal of Communication Disorders*, *87*. https://doi.org/10.1016/j.jcomdis.2020.106025

NELP. (2008). Developing early literacy: A scientific synthesis of early literacy development and implications for intervention. Retrieved April 21, 2022, from https://lincs.ed.gov/publications/pdf/NELPReport09.pdf

Reid D, Chiu T, Sinclair G, Wehrmann S, & Naseer Z. (2006). Outcomes of an occupational therapy school-based consultation service for students with fine motor difficulties. *Canadian Journal of Occupational Therapy*, *73*(4), 215–224. doi: 10.1177/000841740607300406

Reynolds, S., Kuhaneck, H. M., & Pfeiffer, B. (2016). Systematic review of the effectiveness of frequency modulation devices in improving academic outcomes in children with auditory

processing difficulties. *American Journal of Occupational Therapy*, *70*(1), 1–12. https://doi.org/10.5014/ajot.2016.016832

Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J. (2003). Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versus chairs. *American Journal of Occupational Therapy*, *57*, 534–541. doi: 10.5014/ajot.57.5.534

Shaffer, R. J., Jacokes, L. E., Cassily, J. F., Greenspan, S. I., Tuchman, R. F., & Stemmer Jr, P. J. (2001). Effect of Interactive Metronome® training on children with ADHD. *The American Journal of Occupational Therapy*, *55*(2), 155-162. doi: 10.5014/ajot.55.2.155

Shanahan, T., & Lonigan, C. J. (2010). The National Early Literacy Panel: A summary of the process and the report. *Educational Researcher*, *39*(4), 279-285. https://doi.org/10.3102/0013189X10369172

Taipalus, A. C., Hixson, M. D., Kanouse, S. K., Wyse, R. D., & Fursa, S. (2017). Effects of therapy balls on children diagnosed with attention deficit hyperactivity disorder. *Behavioral Interventions, 32*(4), 418-426. https://doi.org/10.1002/bin.1488

The City University of New York. (2016). *Blackboard*. Queensborough Community College. https://www.qcc.cuny.edu/techtools/Blackboard-Tools.html

Wangkawan, T., Lai, C., Munkhetvit, P., Yung, T., & Chinchai, S. (2020). The development and psychometric properties of the visuospatial working memory assessment (VWMA) for children. *Occupational Therapy International*, 1–10. https://doi-org.proxy01.shawnee.edu/10.1155/2020/8736308

Warren, M. & Nobles, L. B. (2016). Occupational therapy services for persons with visual impairment. *American Occupational Therapy Association*.

Wehrmann S, Chiu T, Reid D, & Sinclair G. (2006). Evaluation of occupational therapy school-based consultation service for students with fine motor difficulties. *Canadian Journal of Occupational Therapy*, *73*(4), 225–235. https://doi.org/10.2182/cjot.05.0016

- Zachry, A., Arnwine, R., and Garrett, A. (2020). The effectiveness of iPad apps to improve handwriting legibility in first and second grade students: A pilot study. *Journal of Occupational Therapy, Schools, and Early Intervention, 13*(4), 410-419. https://doi.org/10.1080/19411243.2020.1751768

Zentall, S. S., & Lee, J. (2012). A reading motivation intervention with differential outcomes for students at risk for reading disabilities, ADHD, and typical comparisons: "Clever is and clever does." *Learning Disability Quarterly*, *35*(4), 248–259. https://doi.org/10.1177/0731948712438556