Critical Review of the Literature: Does phonological awareness predict oral reading in individuals with Down syndrome?

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Abstract: This critical review examined whether phonological awareness predicts oral reading in individuals with Down syndrome in six studies. Study designs included: one single-group pre-post test research study, two single-group post-test only research studies, and three case-control research studies. Overall, the evidence suggests that phonological awareness does not predict oral reading in individuals with Down syndrome. The results were not strong enough to suggest clinicians to use phonological awareness skills to teach oral reading to individuals with Down syndrome. Further research is needed in this area.

Introduction

Down syndrome (DS) is a chromosomal disorder caused by an extra 21 chromosome. Individuals with DS possess unique developmental characteristics in the areas of speech and language, memory, and cognition. Their visual skills are better than their verbal skills and their receptive vocabulary is better than their expressive language and grammar skills (Snowling, Nash, & Henderson, 2008). Reading single words aloud is another area of relative strength for children with DS (Bryne, MacDonald, & Buckley, 2002). Although, individuals with DS show strengths in reading, they are not universal due to individual variations in sub-domains of reading skills (Roch & Jarrold, 2008).

The contribution of phonological awareness (PA) has received a lot of attention as a predictor of reading acquisition in typically developing (TD) children (Boudreau, 2002). Phonological awareness requires attending to, thinking about, and manipulating individual phonemes within syllables and spoken words (Scarborough & Brady, 2002). Phonological awareness covers a range of concepts including: rhyming, segmentation, blending, manipulation, categorization, and identification (Scarborough & Brady). Research has demonstrated PA strongly predicts oral reading abilities in TD children. Studies have found reciprocal or bidirectional relationships between PA and reading in TD preschool and kindergarten children (Burgess & Lonigan, 1998; Wagner, Torgesen, & Rashotte, 1994). Lonigan, Burgess, Anthony, and Barker (1998) found that PA skills at different complexities predict word reading abilities in TD children. In adults, word reading in also significantly related to PA, drawing parallels between children and adult literacy acquisition (Durgunolu & Öney, 2002).

If PA is a predictor of reading abilities in TD children, than individuals with DS should be able to benefit from the same skills. Literacy skills (e.g., reading) are needed to succeed in school and later in life. Failure to gain reading skills can have social consequences (e.g., low self-esteem, anxiety) as well.

Objectives

The primary objective of this paper is to critically evaluate the literature that has examined whether PA predicts oral reading in individuals with DS. The secondary objective of this paper is to summarize outcomes that can be used as clinical implications when providing evidence-based practice information to clinicians.

Methods

Search Strategy. Computerized databases, including CINAHL, SCOPUS, PubMed, ProQuest, and Scholars Portal were the search databases utilized. The following search strategy was used: ((Down syndrome) OR (Trisomy 21)) AND ((phonological awareness) OR (phoneme awareness) OR (grapheme-phoneme conversion)) AND ((reading) OR (literacy)). The search was limited to the English language and peer-reviewed articles.

Selection Criteria. Studies included in this critical review examined whether PA predicts oral reading in individuals with DS. All subjects held a diagnosis of DS. Studies that did not report results exclusive to oral reading were not included. No limits were set on the demographics of the research participants.

Data Collection. The results of the literature search yielded six articles matching the search criteria mentioned above: one single-group pre-post test research study, two single-group post-test only research studies, and three case-control research studies.

Results

The studies are organized by levels of experimental evidence, from high to low.

Gombert (2002) conducted a non-randomized, case-control, between group study to examine if PA correlates with reading performance in individuals with DS. Eleven French-speaking children with DS participated in the study. A comparison group of 11 younger French-speaking TD children participated in the study. The PA tasks, at a metalinguistic (isolation) and epilinguistic (recognition) level, were: rime judgment, rime oddity, onset oddity, phoneme synthesis, phoneme counting, and phoneme deletion. Reading was assessed through four tasks using monosyllabic/bisyllabic words, irregular words, neighbour nonwords and non-neighbour nonwords.

Statistical methods used were analysis of variance (ANOVA) and Pearson correlations. The author found a strong link between PA and reading performance in children with DS. Onset oddity, at isolation, was correlated with reading performance (r=0.53). Phonological awareness tasks at the recognition level were not correlated with reading performance (r=0.10).

Strong correlations were found between PA and reading performance in children with DS. Multiple regressions were not conducted in this study as they hypothesized a correlation effect between PA and reading performance in children with DS and TD children. For the purpose of this current review, this study does not provide support for PA predicting oral reading in children with DS, but there was a relationship. This result coincides with TD children and the strong relationship between PA and reading.

Roch and Jarrold (2008) conducted a non-randomized, case-control, between group study to examine the role of PA in learning to read in children with DS. Twelve individuals with DS participated in the study. Fourteen TD individuals, based on comparable word reading skill level, also participated in the study. The PA tasks were: initial sound detection, phoneme deletion, and rhyme detection. Reading was assessed through: regular one-and two-syllable words in high frequency, irregular one- and two-syllable words, and nonword one-and two-syllable nonwords.

The authors used a series of t-tests, with family-wise Bonferroni correction, and correlations. The results indicate individuals with DS showed a strong relationship between PA skills and nonword reading (r=0.79). It was also found that individuals with DS showed lower levels of nonword reading accuracy but higher levels of irregular reading accuracy than TD individuals.

The interpretation of results was two-fold, as well as contradictory. The authors found a relationship between PA and nonword reading skills. The authors interpreted their results suggesting that individuals with DS use the visual approach for irregular word reading rather than PA. Given that irregular word reading relies on the visual approach, it is expected that this approach is adopted, making individuals with DS visual learners.

One of the purposes of this study was to determine whether there was any relationship between PA skills and reading ability in DS. The predictor variables (i.e., PA skills) and outcome variables (i.e., oral reading) could have been used to conduct regression analyses; but this was lacking in the study. Unlike the previous study, this study suggests that individuals with DS are visual learners and do not learn like the TD individuals through PA. Overall, these results do not suggest PA predicts oral reading in individuals with DS. However, like TD children, they use the 'visual form' to recognize words. Typically developing children use this strategy when reading irregular words because these words would be read incorrectly if sounded out (Roch & Jarrold, 2008).

Verucci, Menghini and Vicari (2006) conducted a non-randomized, case-control, between group study to examine the results between reading and PA skills in individuals with DS. Seventeen Italian-speaking individuals with DS, along with 17 Italian-speaking reading-age matched TD individuals, participated in the study. The PA tasks were: syllable blending, syllable segmentation, syllable deletion, rhyme detection, and first syllable recognition. Reading was assessed with the Battery for Evaluating Dyslexia and Dysorthography.

Correlations and analysis of covariance (ANCOVA) were used as statistical methods for the study. The results indicate individuals with DS presented with reading abilities comparable to TD controls for word reading, passage reading, and irregular word reading. First syllable deletion was correlated with reading isolated words. However, individuals with DS failed in nonword reading. As the previous study suggested individuals with DS could be visual learners. Therefore, individuals with DS would have tremendous difficult sounding out nonwords using the PA approach.

Authors could have performed regression analyses because the purpose of the study was to investigate

reading abilities in relation to PA with individuals with DS to TD individuals; however, it was not. Therefore, the results of this study do not suggest that PA predicts oral reading in individuals with DS.

Cupples and Iacono (2000) conducted a longitudinal single-group, pre-post test, within study examining the co-development of PA and oral reading skills in children with DS. Twenty-two children with DS participated in the first assessment of PA and reading achievement. Nineteen children with DS participated in the second assessment, which took place 7 to 12 months later. The PA tasks were: rhyming, alliteration, phoneme blending (real words and nonwords), and phoneme segmentation (real words and nonwords). Reading was assessed with the *Woodcock Reading Mastery Tests-Revised*.

Spearman's p correlations and stepwise multiple regressions were the statistical methods used. The results indicate PA and early oral reading skills are positively associated in children with DS. Phoneme segmentation skills were positively related the ability to read real words, as well as superior nonword reading in children with DS. Phoneme segmentation skills at initial assessment accounted for significant proportion of variance in nonword reading at follow-up.

A positive correlation as well as a predictive relationship was found between PA and oral reading for children with DS. Further studies need to be conducted or replicated to see if a true prediction between PA and oral reading exists. A comparison group should be considered for future studies as well; as this study did not compare individuals with DS with TD individuals as previous studies. This study did find some evidence that PA predicts oral reading in children with DS.

Fletcher and Buckley (2002) performed a single-group, post-test only, within study examining the relationship between PA and reading. Seventeen individuals with DS participated in the study. The PA tasks were: rhyming, alliteration, phoneme blending, and phoneme segmenting. A standardized test, the *British Ability Scale Word Reading Test A*, and a non-standardized test, the Seymour reading task, were administered to assess reading.

Pearson correlations were used to investigate the relationship between PA and oral reading. The results indicate a significant positive relationship between PA and reading in individuals with DS. Specifically, rhyme was correlated with content and functor word reading, alliteration was correlated with content word reading, and blending was correlated with all reading measures.

One hypothesis of this study was that PA will have a positive relationship with reading. A significant positive relationship was found between PA and oral reading. The authors had predictor variables (i.e., PA skills) and outcome variables (i.e., oral reading) to do a regression analysis. However, the statistical analysis was lacking in this study. Overall, these results suggest that PA does not predict oral reading in individuals with DS. Instead, there was a relationship between PA and oral reading in individuals with DS similarly to what other studies found.

Kennedy and Flynn (2003) conducted a single group, post-test only study to examine if there is a relationship between PA and literacy acquisition in children with DS. Nine children with DS participated in the study. The PA tasks were: rhyming, alliteration, initial phoneme isolation, and phoneme blending. Reading was assessed with the *Burt Word Reading Test*, as well as informal tasks of nonword reading and real word reading recognition.

Pearson correlations were used as the statistical method in the study. The results indicate that PA skills were related to reading level in children with DS. Reading level was significantly related to skills of alliteration. This finding was similar to other studies that found a relationship between PA (i.e., onset oddity and initial sound detection) and reading.

The study sought to determine if there was a relationship between PA and reading in children with DS. The authors found a positive correlation between PA and reading. Regression analyses could have been conducted as well to see if there was a prediction between PA and oral reading; however, it was not. These results suggest PA does not predict oral reading, but there is a relationship like other studies found.

The evidence from these six studies needs to be interpreted with caution. Most of the studies presented with various study limitations. Sample sizes, demographics, and background information of participants were limitations. Some sample sizes were quite small. This is of concern as the power of statistical analyses may have been compromised. In regards to demographics, age ranges and gender of the participants were not included. Some of the participants had been receiving early reading instruction or support from children centres, as well as attending mainstream schools since they were young. Therefore, generalizing results to other children with DS should be done with caution. Another limitation of a study was the poorly written "discussion" section

with no implications or rationales provided by Gombert (2002). Furthermore, the author included the mean WISC IQ scores of both groups, however, failed to consider and perform any statistical analyses on any differences in IQ among the groups. Lastly, the study by Cupples and Iacono (2000) was a longitudinal study. Therefore, gains developed by the children with DS could have been due to developmental changes or educational benefits.

Taken together, the studies provided either level 2B or level 3 experimental evidence. These were considered either one or two levels below the ideal or 'gold-standard' experimental design. Due to methodological restrictions, such as sample size and demographics, it is impossible to increase experimental evidence to level 1.

Discussion

This section of the critical review will discuss patterns found among all studies presented up above. Despite the limitations discussed in the previous section, some important trends emerged.

First, predictive results were not found between PA and oral reading skills in individuals with DS. Only one study, by Cupples & Iacona (2000), found some evidence for a predictive relationship between phoneme segmentation skills and nonword reading in children with DS because multiple regressions were analyzed. A study by Gombert (2002) hypothesized a correlation effect between PA and reading skills, so regressions were not conducted. The other four studies were investigating a relationship between PA skills and oral reading. The type of relationship being sought was not specified; therefore, questionable about why multiple regressions were not conducted. Two variables need to have a strong positive correlation as a prerequisite to conducting multiple regressions to see if there is a predictive relationship. Further studies need to be done or current studies need to be replicated to find whether or not there is a predictive relationship between PA and oral reading in individuals with DS.

Second, positive correlations were found between PA and oral reading skills in individuals with DS. Pearson correlations were performed in all studies. Only one strong correlation was found between alliteration (also called onset oddity or initial sound detection in studies) and real word and/or nonword reading among studies. Some other correlations were found between phoneme deletion, first syllable deletion, phoneme segmentation, rhyme, and blending with real word and/or nonword reading; however, a strong collective trend was not found between studies.

The discrepancy in results could be due to the dissimilarities in assessment tasks. All studies conducted the same range of concepts used in PA (i.e., rhyming, segmentation, blending, alliteration, etc). All studies, except one, looked at PA at the word level. Verruci, Menghini and Vicari (2006) performed PA tasks at the syllable level. Measuring PA at the word level or syllable level present with different complexities. This does not allow for a fair comparison between PA tasks and the subjects.

All studies assessed the same reading skills. Gombert (2002), Roch and Jarrold (2008), and Verruci, Menghini and Vicari (2006) used informal methods of assessing reading; whereas, Cupples and Iacono (2002) used formal measures only. Fletcher and Buckley (2002) and Kennedy and Flynn (2003) used both informal and formal methods of assessment for oral reading. Formal and informal assessments cannot be comparable at the same level. The formal tests were norm-referenced towards the typical population and not the DS population. Informal assessments did not consider blinding procedures to avoid influences on internal validity. Therefore, assessing individuals with DS can lead to differences in results due to unfair grounds of comparison, even though all assessment measures were looking at oral reading outcomes.

Differences in results could also be due to the various age ranges. Reading skills are not universal due to individual variations in sub-domains of reading skills in this population (Roch & Jarrold, 2008). Some participants were receiving early reading instruction or support from children centres, as well as attending mainstream schools at various ages. This could affect the performance levels of the individuals.

Two out of six studies assessed the individuals in another language other than English. Gombert (2002) assessed PA and oral reading in French and Verucci, Menghini and Vicari (2006) in Italian. The other studies assessed the participants in English. This could affect the results of the study as French, Italian and English are different languages, and may not be a fair comparison and therefore present with different results.

Although positive correlations were found in all studies, they were not as significant. This could be due to dissimilarities in assessment methods, various age ranges, and different languages of participants.

Clinical Implications. Based on the critical evaluations aforementioned, clinicians want to know the implications the results have in their profession as speech-language pathologists (SLPs).

This critical appraisal of relevant research found that phonological awareness does not predict oral reading in individuals with DS. There was, instead, a positive correlation between alliteration and real word and/or nonword reading. However, these results were not strong enough to suggest clinicians to employ PA skills to teach oral reading to individuals with DS.

It should be noted that clinicians should not be using PA skills to help oral reading in individuals with DS. Individuals with DS have better visual skills than their verbal skills Snowling, Nash, & Henderson, 2008). Therefore, visual strategies need to be used to help this population with literacy (e.g., reading). The strengths children with DS have should be used to help them read and become skilled readers in later life.

More compelling evidence is needed before SLPs consider or put into practice teaching children with DS PA skills to aid with reading. Overall, current evidence does not suggest implications for clinicians to use PA skills for oral reading in this population of DS.

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