Critical Review:
Examining the Predictive Value of Oral Language Variables on Measures of Reading Achievement

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This critical review examines the ability that specific oral language measures have on predicting measures of reading achievement. A literature search was conducted and study designs included five case series and two case reports. Findings indicate that pseudo-word reading is best predicted by phonological awareness and word recognition is best predicted by phonological awareness and a measure of semantic skill. Reading comprehension is best predicted by a measure of semantic ability and grammar for children up to grade three, and a measure of semantic skill and listening comprehension for children from grade three to eight.

Introduction

In 2004, it was estimated that between 5-12% of school-aged children in the United States of America had a reading disability (Monsen, 2004). Children with reading disabilities can have difficulty with single-word reading as well as reading comprehension (Paul, 2007). Oral language abilities are considered to be an underlying component in a child's reading development. A child with an oral language deficit in the preschool years is considered to be at risk for successful literacy acquisition (Roth, Speece, & Cooper, 2002).

Research focused on discovering more about the link between oral language and reading skill has been ongoing for the last 30 years (Catts, Fey, Zhang, & Tomblin, 1999). Even though a body of evidence has developed supporting the importance of various oral language abilities on reading achievement, the majority of these studies examined the relative contributions of only one or two aspects of oral language as opposed to considering multiple areas (Purvis & Tannock, 1997; Vogel, 1977). Even fewer studies have examined the predictive value of individual oral language abilities on the differing measures of reading achievement within the confines of one study (Betourne & Friel-Patti, 2003; Catts, Fey, Tomblin, & Zhang, 2002; Catts, Fey, Zhang, & Tomblin, 2001; Nation & Snowling, 2004; Roth et al., 2002). Having the explicit knowledge of the predictive value of certain areas of oral language on future reading skills would provide useful information to speech-language pathologists (SLPs) in helping to identify children at-risk for reading difficulties.

Usually by the time a child begins formal education within a school setting, they have already developed their basic oral language skills. Once in the school system, most children begin receiving formal reading instruction. Although most learn to read without much difficulty, there is always a subset that struggle. These children are typically only identified after they have experienced significant difficulties acquiring the age-appropriate reading skills (Catts, 1997). By the time a child is identified and intervention has begun, the individual has already fallen behind his peers and is left struggling to catch up. Such a reading failure can contribute to many negative consequences. Children who experience early difficulties with reading typically become less motivated to read, have low expectations of their abilities, receive less practice and experience reading compared to their peers that are good readers (Catts, 1997), and experience increased levels of frustration. If clinicians knew which oral language skills predicted which areas of future reading abilities, more children would be identified earlier as being at-risk for having reading difficulties prior to them even receiving formal reading instruction. Catts et al. (2001) argue that not only would children be identified earlier, but the early intervention that would come as a result could significantly reduce or prevent the difficulties with reading acquisition as well as many of the negative consequences associated with reading failure.

Objectives

The purpose of this paper is to critically examine the existing literature regarding the predictive value of young children's oral language abilities on their future reading abilities. This paper will seek to identify which oral language abilities in particular are predictive of which future reading abilities. Evidence-based recommendations and future research directions will be discussed.

Methods

Search Strategy
Online databases (Proquest Education, Medline, Scopus, and PubMed) were searched using the search terms (oral language) AND ((reading achievement) or (reading

abilities)). The reference lists of the studies found in the databases were also searched for relevant articles.

<u>Selection Criteria</u>
The search was limited to studies that examined reading achievement in school-aged English-speaking children and assessed multiple areas of oral language abilities.

<u>Data Collection</u>
The results from the literature search generated seven nonexperimental studies: five case series and two case reports. All studies examined at least one of three measures of reading achievement: pseudo-word reading (nonsense words), single-word recognition (real words), and reading comprehension.

Results

Pseudo-Word Reading:
Betourne and Friel-Patti (2003) and Roth et al. (2002) both incorporated measures of pseudo-word reading into their studies. The case report study by Betourne and Friel-Patti (2003) examined which oral language measures predicted various measures of reading abilities in fourth grade poor readers. The authors' sample included 17 participants whose oral language measures of semantic, syntactic, morphological, rapid naming, and phonological awareness (PA) abilities were assessed using standardized tests. Multiple and stepwise regression analyses were carried out to determine which variables predicted the variability in pseudo-word reading. The PA task of the Comprehensive Test of Phonological Processing (CTOPP) was found to be a significant predictor of pseudo-word reading, contributing to 34% of the variance. The Grammaticality Judgment task (a measure of syntax and morphology) from the Comprehensive Assessment of Spoken Language (CASL) was also a significant predictor, contributing 31% of the variance. When a stepwise regression analysis was carried out, both the Grammaticality Judgment and PA tasks contributed a moderate amount of variance (35-41%).

The study by Roth et al. (2002) used a slightly different approach. The researchers used a case series design to determine which oral language variables as measured in kindergarten were predictive of first and second grade reading abilities. They followed 39 kindergarten students through to the second grade, measuring oral language and/or reading abilities each year. Kindergarten oral language measures included tasks related to semantics, syntax, PA, metasemantics (producing and comprehending idioms and lexical ambiguity), and narrative comprehension and production. A multiple regression analysis was conducted to determine which kindergarten variables predicted reading abilities in the first and second grade. The researchers employed a two stage analysis. During the first stage, the investigators sought to determine if there were any measures within certain domains (i.e., structural, metalinguistic, narrative discourse, and background variables) that accounted for unique variance in reading. During the second stage, the significant variables found in part one were used simultaneously to establish their predictive value on each of the three reading measures. When determining predictors of first grade pseudo-word reading, PA and metasemantics within the domain of metalinguistics, along with the autoregressor (pseudo-word reading in kindergarten) were found to be significant, accounting for 73% of the variance. Within the domain of structural language, comprehension of syntax and the autoregressor accounted for 69% of the variance. When the final model was tested, grade one pseudo-word reading skills was found to be best predicted by pseudo-word reading measures in kindergarten, PA, IQ, and family literacy, with the overall $R^2=0.80$. Pseudo-word reading skills in grade two was found to be best predicted by PA skills within the metalinguistics domain, accounting for 61% of the variance, and syntax comprehension within the structural language domain, accounting for 23% of the variance. When the final model was tested, pseudo-word reading in grade two was best predicted by PA abilities alone ($R^2=0.61$).

Single-Word Recognition:
Betourne and Friel-Patti (2003) found that the Grammaticality Judgment task and the Sentence Completion task (a measure of semantics) from the CASL predicted 30% and 25% of the grade four word recognition variance, respectively. When both of these measures were entered into the stepwise regression analysis there were no changes in r^2.

Support for semantic ability as a predictor was proposed in a case report by Wise, Sevcik, Morris, Lovett, and Wolf in 2007. The researchers sought to determine what the relationship between receptive and expressive vocabulary, listening comprehension, pre-reading, word identification, and reading comprehension was in children with reading disabilities. Their sample included 279 second and third grade students and used structural equation modeling (SEM) to test a possible causal relationship among the oral language and reading variables using a hybrid model (i.e., measurement models combined with path analysis models). The results revealed weak correlations. The researchers found that expressive vocabulary had a coefficient of 0.2 with word recognition ($p<0.05$). They also reported that listening comprehension had a significant, independent path to word identification of 0.23 ($p<0.05$), however, the measure used to assess listening

comprehension abilities did not truly reflect pure listening comprehension, as the task also involved a receptive vocabulary component.

Roth et al. (2002) examined the ability of oral language skills in kindergarten children to predict later reading abilities. The authors found that predictors of first grade word recognition included PA and metasemantic skills from the metalinguistic domain (4% and 5%, respectively), and receptive syntax from the structural language domain (9%). When the final model was tested, word recognition measures from kindergarten, PA, and metasemantics accounted for 75% of the variance. Second grade word recognition skills were found to be best predicted by PA skills (60% of the variance) within the domain of metalinguistics, and word retrieval (16% of the variance). When the final model was tested, only PA skills were retained, accounting for 61% of the variance.

In 2004, Nation and Snowling also examined oral language variables and their predictive value on single-word recognition in children at ages 8.5 and 13 using a case series design. The researchers sought to identify which individual differences in language would predict which individual differences in reading. Nation and Snowling (2004) performed hierarchical regressions to assess concurrent predictors of word recognition at age 8.5, and found that after considering age and nonverbal ability, pseudo-word reading (which they included as a possible predictor of word recognition and reading comprehension as opposed to assessing it as a measure of reading achievement in itself) and PA skills accounted for 72% of the variance. Semantic abilities (defined as a combined measure of semantic fluency, i.e., ability to generate a list of semantically related words to a given target, and synonym judgment, i.e., ability to identify synonyms), expressive vocabulary, and listening comprehension contributed 4.0%, 3.8%, and 3.0% of the variance, respectively. After examining longitudinal predictors of word recognition when the participants were 13 years of age, they found that after age and nonverbal IQ, the autoregressor accounted for 59.8% of the variance. Pseudo-word reading and PA skills added in as the next step accounted for 9.9% of the variance. Semantic, vocabulary, and listening comprehension abilities accounted for 1.9%, 1.9%, and 2.4% of the variance, respectively.

Pseudo-Word Reading and Single-Word Recognition:
Studies by Catts et al. (2002) and Catts et al. (1999) used case series designs and combined measures of pseudo-word reading and single-word recognition to form one composite measure. Catts et al. (2002) sought to discover which variables in children with language impairments (LI) were predictive of reading

achievement in second and fourth grades. They examined the predictive value of oral language measures (i.e., semantic composite, grammar composite (measures of grammar and sentence imitation), narrative composite (measures of narrative retell and comprehension), rapid naming, and PA) as measured in kindergarten on the composite measure of word reading in grades two and four, using a sample of 208 children. Using stepwise multiple regression analyses, the researchers found that letter identification, PA skills, rapid naming, and nonverbal IQ accounted for 36.1% of the variance in grade two word reading, and second grade word recognition and PA skills accounted for 75.8% of the variance in fourth grade word reading.

The results from the study by Catts et al. in 1999, lends support to the importance of grammar and PA on word reading abilities. In this study, the researchers sought to discover which kindergarten variables were correlated with second grade reading abilities. Oral language abilities of 593 kindergarten students were examined and compared to their second grade word reading abilities. The sample was comprised of children with LI or nonverbal cognitive deficits, as well as children who were typically developing. Oral language measures examined included rapid naming and PA as well as oral language composite measures that examined semantic, grammar (including measures of grammar and sentence imitation), and narrative abilities (including measures of retell and comprehension). Correlations were computed between the kindergarten and second-grade variables and all language measures were found to be moderately to highly correlated with second grade word reading measures. Grammar was the most closely related variable to word recognition (0.592), followed by PA skills (0.573), p<0.001.

Reading Comprehension:
Betourne and Friel-Patti (2003) found that the Grammaticality Judgment task from the CASL accounted for the largest amount of variance (39%) in fourth grade reading comprehension. This was followed by the Sentence Completion task, also from the CASL, which contributed 30% to the variance.

Catts et al. (1999) lends support to this. The researchers computed the correlation measures between all measured kindergarten language and second grade reading variables and found that the most closely related variable to reading comprehension was grammar (0.689), followed by vocabulary (0.590), p<0.001.

Although Roth et al. (2002) also found evidence for the predictive value of vocabulary, they did not find evidence for grammar. During their first stage of analysis, they found that predictors of first grade

reading comprehension included narrative production from the narrative discourse domain ($R^2=0.06$), PA from the metalinguistics domain ($R^2=0.08$), and oral receptive abilities (as measured by tasks in semantics, syntax, and morphology) ($R^2=0.05$), expressive vocabulary ($R^2=0.02$) and word retrieval ($R^2=0.08$) from the structural language domain, beyond the effects of the autoregressor (in this case, print awareness measures from kindergarten). When the final model was tested, the autoregressor, oral vocabulary, narrative production, and family literacy accounted for 74% of the variance. Second grade reading comprehension was found to be best predicted by PA skills (4% of the variance) within the domain of metalinguistics, narrative comprehension (16% of the variance) within the domain of narrative discourse, and oral vocabulary and word retrieval (9% and 6% of the variance, respectively) from the structural domain. When the final model was tested, only the autoregressor, oral vocabulary, and word retrieval were retained, together accounting for 71% of the variance.

Nation and Snowling (2004) found that after considering age and nonverbal ability in a hierarchical regression analysis, concurrent predictors of reading comprehension abilities at age 8.5 included nonword reading & PA (20.4% of the variance). When semantic abilities, vocabulary skills, and listening comprehension were entered independently as the third step in the analysis, each contributed to 15.1%, 25.2%, and 30.8% of the variance in reading comprehension, respectively. When longitudinal predictors of reading comprehension at age 13 were examined, Nation and Snowling (2004) found that after age and nonverbal IQ were entered as the first step, reading comprehension from age 8.5 accounted for 32% of the variance. Nonword reading and PA were entered next, accounting for 15.7% of the variance. Three separate regressions were conducted for the final step, revealing that semantic skills, vocabulary, and listening comprehension contributed 4.5%, 4.9%, and 14.1% to the variance, respectively.

Catts et al. (2002) examined the predictive potential of kindergarten variables on grade two and four reading comprehension. Using stepwise multiple regression analysis, they found that letter identification, grammar composite, nonverbal IQ, and rapid naming accounted for 36.7% of the variance in grade two reading comprehension, and letter identification, nonverbal IQ, rapid naming, and PA accounted for 23.8% of the variance in fourth grade reading comprehension. The researchers also found that the best second grade measures to predict fourth grade reading comprehension was second grade reading comprehension and the grammar composite, which contributed 60.3% of the variance (Catts et al., 2002).

Another case series article by Catts et al. (2001), sought to find a mathematical equation that could be used to estimate the risk that any given child in kindergarten would have reading difficulties in second grade based on measurable variables. The sample included 328 participants with LI and/or nonverbal cognitive deficits, and 276 participants without any impairment to form a control group. All participants were given a battery of language and early literacy tests in kindergarten and followed up with reading measures (comprehension only) in second grade. Catts et al. (2001) used a logistic regression analysis to determine the likelihood of a child in kindergarten having reading difficulties in grade two. The results identified letter identification as being the best predictor of reading difficulties in second grade (Wald $X^2=25.7$; $p<0.0001$), followed by sentence imitation (Wald $X^2=25.6$; $p<0.0001$), mother's education (Wald $X^2=12.0$; $p<0.001$), sound deletion in a word (PA) (Wald $X^2=9.1$; $p<0.01$), and rapid naming (Wald $X^2=4.4$; $p<0.05$).

Discussion

All of these studies were case series or reports, and are rated at evidence level four according to the Oxford Centre for Evidence-Based Medicine Levels of Evidence (Phillips et al., 2001, as cited in Dollaghan, 2007). The relative level of validity and importance of each study was evaluated by examining participant selection, methodology and result analysis.

Nation and Snowling (2004), Catts et al. (2002), and Roth et al. (2002) were rated as having the highest level of validity and importance. All three studies had fair sample sizes, and both Nation and Snowling (2004) and Roth et al. (2002) used samples that fairly represented the population. It is unclear whether or not Catts et al.'s (2002) sample was also as representative.

Considering methodology, all three studies rated highly on construct, content, and face validity, and attempted to control for external variables. However, none mention if the examiners' were blinded to the purpose of the study or to the information on the participants. Having such knowledge may have influenced their observations or scoring. Also, there is no mention as to whether or not all of their tests were administered in the same order for each participant, and therefore there is the possibility of an order effect.

When analyzing the results, all three studies used appropriate statistical analyses. Catts et al. (2002) and Roth et al. (2002) both used multiple regression analyses because it allows for the examination of how multiple variables predict the variability in a certain measure of interest. Nation and Snowling (2004) used

hierarchical regression analyses as they sought to determine which variables accounted for more of the variability on the different measures of reading achievement, and this procedure allows for that.

The remaining four studies were given mixed ratings on their validity and importance. Regarding participants, both studies by Catts et al. (2001, 1999) had large sample sizes and included children with LI, nonverbal cognitive deficits, and children who were typically developing, while Betourne and Friel-Patti (2003) had only 17 participants, all of whom were selected by their teachers as being poor readers. In addition, both studies by Catts et al. (2001, 1999) were determined to have fair representation of the general population within its sample. Catts et al. (2001, 1999) applied a weighting procedure to make their samples comparable to that of the population. In contrast, Betourne and Friel-Patti's study (2003) sampled only from a suburb of a major metropolitan area with moderate to high socioeconomic status (SES), and do not mention the gender distribution or ethnicity of the participants. However, this did allow the researchers to have more control over external variables such as SES. Wise et al. (2007) had a large sample size and was judged to be a fair representation of the population, but the sample included only children who were selected by their teachers as having difficulty learning to read.

Considering methodology, all four studies either provided training to examiners or used SLPs, but unfortunately, none of the studies mention if the examiners' were blinded to the purpose of the study or to the information on the sample. Both Betourne and Friel-Patti (2003) and Catts et al. (1999) had good construct, content, and face validity. Catts et al. (2001) rated poorly in these three domains because the researchers only used measures of reading comprehension in their analyses despite claiming that the purpose of their study was to find a mathematical equation that could be used to determine future reading achievement. Therefore it is only reasonable to assume that the study results are applicable to predicting reading comprehension only. Wise et al. (2007) also rated poorly on construct validity mainly due to the language comprehension measure. Since the Listening Comprehension subtest of the Wechsler Individual Achievement Test involves a receptive vocabulary component this may have confounded the measurement.

Regarding results, all four studies used appropriate statistical analyses. Betourne and Friel-Patti (2003) used multiple and stepwise regression analyses to first determine which variables predicted the variability in the distinct measures of reading achievement, and then to determine which variables accounted for more of the

variability. Catts et al. (2001) employed a logistic regression analysis so as to determine the link between certain variables (including measures of oral language) and reading comprehension. This form of analysis produces the probability of X occurring based on risk factors Y. Catts et al. (1999) used a Pearson product-moment correlation analysis to measure the relation between individual oral language variables and distinct measures of reading because the researchers sought to establish how well individual oral language measures related to reading measures. Wise et al. (2007) used SEM to test a proposed causal relationship amid the latent and observed variables using a hybrid model. This was an appropriate choice of analysis, as the researchers only sought to investigate the validity of a proposed causal relationship between the variables. The researchers include a caution about interpretation of their results however, because even though the results are based on model fit, there are other possible models that could explain the results with no guarantee that these relationships actually exist within the real world.

Conclusion

The studies that comprised this critical appraisal were very diverse. Although they all examined oral language and reading abilities of school-aged children, the samples included in the studies were of varying ages, ranging from kindergarten through to grade eight. The oral language measures themselves that the groups of investigators chose to include in their studies were also quite assorted, as some researchers decided to include certain variables and not others. The varying ages and inconstant inclusion of similar oral language measures, as well as the varying levels of validity of the studies made it challenging to draw conclusions as to which measures of oral language predicted which measures of reading achievement. Despite these challenges, tentative conclusions have been drawn.

According to current research (Betourne and Friel-Patti, 2003; Roth et al., 2002), it appears that pseudo-word reading abilities from grades one through to four are best predicted by PA abilities although grammar skills may also contribute to some of the variance.

The oral language measures that appear to be the most common predictive variables of single-word recognition in most of the studies are PA and a measure of semantic skill (Nation and Snowling, 2004; Roth et al., 2002). Because of the diverse nature of the studies examined it is not easy to determine how these oral language measures impact word recognition skills across the school grades. In fact, for the studies that examined word recognition abilities longitudinally, often prior word recognition and/or pseudo-word reading measures

were included as the autoregressor when determining the predictive value of variables on later word recognition abilities (Nation and Snowling, 2004; Roth et al., 2002). Therefore, perhaps at a very young age (e.g., up to grade two) PA and a measure of semantics are better predictors of single-word recognition skills, but as a child ages (e.g., grades three through eight), although PA and semantics remain important, it is prior word recognition and pseudo-word reading abilities that become the most important predictive variables.

For the two studies that combined pseudo-word reading and single-word reading abilities into one composite measure (Catts et al., 2002; Catts et al., 1999), the overall results also support PA skills as having a large role in predicting grades two and four word recognition and pseudo-word reading abilities.

As with word recognition, it is also challenging to draw conclusions as to which variables are best to predict reading comprehension abilities. Overall, the oral language measures that appeared to be the most common predictive variables of reading comprehension in the younger grades (i.e., up to grade three) for most of the studies were a measure of semantic skills and grammar (Roth et al., 2002; Catts et al., 1999). Examining the results of the studies that included older participants (i.e., grades three, four and eight), it appears that although semantics still play a role in predicting reading comprehension, the importance of grammar was not as evident in all of the studies. However, listening comprehension and early measures of reading comprehension were found in most of the studies as having a stronger role in predicting the variance in reading comprehension abilities in older children (Nation and Snowling, 2004; Catts et al., 2002).

Clinical Implications

The result of this critical review reveals the predictive value of the aforementioned oral language skills on measures of reading abilities and emphasizes the importance of early identification of oral language difficulties in children. For those children who SLPs identify as struggling with the abovementioned language skills and are therefore at risk for future reading difficulties, inclusion of early and ongoing literacy facilitation as a component of oral language treatment would be proactive.

Since oral language difficulties are related to later reading difficulties, the SLP should provide this information to parents and other professionals and encourage referral for oral language development. Through early identification and remediation of these oral language deficits it is possible that future

difficulties with reading acquisition can be reduced or prevented.

Future research to confirm the relationships between oral language abilities and measures of reading achievement should incorporate multiple measures of oral language, be longitudinal in design to include language and reading measures of children beginning at junior kindergarten through to grade eight, and involve both children with language difficulties and children that are typically developing as a comparison group. In addition, the samples used should be stratified on variables such as ethnicity, geographical location, SES, and gender to allow for better generalization to the population at large. Furthermore, research illustrating how literacy development can be influenced by SLP services should be conducted using pre and post measures of language and literacy abilities of students receiving language therapy compared to controls, such as students on a waiting list for services.

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