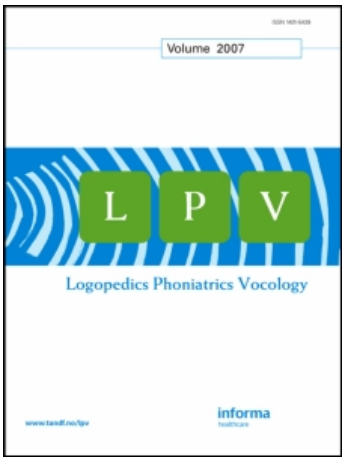

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The role of analogies in learning to read

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A number of factors contribute to proficient word recognition, including phonological awareness and the ability to make orthographic analogies. The present study considered the relative contribution analogy abilities make toward early reading ability. Two analogy tasks and measures of phonological awareness, orthographic knowledge, visual memory, general language ability, and non-verbal intelligence were administered to 20 second grade good readers and 20 third and fourth grade poor readers. The analogy tasks did make a significant contribution to early reading ability; however, the analogy tasks were not very different from the measures of reading they predicted. In other words, it seems difficult to isolate the use of analogies from basic phonological decoding abilities.

Key words: reading development, analogies, reading disabilities.

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INTRODUCTION

A number of factors contribute to proficient word recognition, including phonological awareness and the ability to make orthographic analogies. The role that analogical abilities play in word recognition proficiency is the least understood of these abilities. Goswami (5) found that first grade children have the ability to use analogies; however, it was unclear from her study how frequently first grade children use analogies as they learn to read and the relative contribution analogical abilities make toward early reading ability. In the present study, we attempted to address the second question by administering two analogy tasks and measures of phonological awareness, orthographic knowledge, visual memory, general language ability, and non-verbal intelligence to good and poor readers reading at the second grade level.

The first analogy task was adapted from Goswami (5), using words that second grade readers did not know. In addition, because we expected that children would have difficulty with this task, we developed a dynamic analogy task to determine whether children could be taught to make analogies. We hypothesized that the ability to use analogies would make a significant contribution to second grade reading ability and that the dynamic analogy measure would differentiate between the good and poor readers.

METHOD

Subjects

Subjects were 20 normally developing second grade children (11 boys, 9 girls) ranging in age from 7 to 9 years (mean = 7.7 years) and 20 third and fourth grade poor readers (11 boys, 9 girls) ranging in age from 9 to 11 years (mean = 10.0 years). The poor readers were matched to the good readers on the word identification subtest of the Woodcock Reading Master Test—Revised (WRMT-R) (11). All of the poor readers performed at least 1 SD below the mean on the word attack (non-words) of the WRMT-R (Table 1). All of the children performed within normal age limits on the Test of Nonverbal Intelligence (TONI-2) (2). Only children who could not read any of the words on the analogy task were included.

General procedures

Testing was conducted in two sessions. In the first session, children were administered the TONI-2 (2), the picture vocabulary and grammatical understanding subtests from the Test of Language Development (TOLD-P:III) (7), and the letter identification, word identification and word attack (reading non-words) subtests from the WRMT-R (11).

In the second session, children were administered an orthographic knowledge task (8), two measures of phonological awareness, a deletion (3) and a seg-

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Table 1. *Means and SDs for good and poor readers for language, cognitive, and reading measures*

	Poor readers	Good readers
Picture vocabulary	7.4 (2.2)	7.7 (2.3)
Grammatical understanding	6.8* (2.1)	8.5 (2.2)
TONI-2	94.5 (11.7)	94.9 (9.8)
Word identification	49.4 (7.7)	49.5 (4.5)
Word attack	11.6** (7.0)	19.6 (10.3)

* $p < 0.05$.
** $p < 0.01$.

mentation task (9), a visual memory task, and a static and dynamic analogy task. These are described in the next section.

Tasks

Orthographic task. The test of orthographic knowledge was modified from Olson *et al*. (8). Children were asked to choose which of two words was the real one (e.g. *rume*, *room*). There were 50 items on the test.

Phonological awareness tasks. Two phonological awareness tasks were administered: a deletion task (3) and the phoneme segmentation task from Sawyer's Test of Language Segments (9). For the deletion task, children had to name the words that were left when a syllable (mon-key) or phoneme (s-pill) were taken away. The phoneme segmentation task required children to indicate the number of sounds in a word.

Visual memory task. The visual memory task was adapted from Mauer and Kamhi (6). The test consisted of 2 training items and 10 test items. The children were given 5 s to look at a visual configuration on an index card. The card was then removed. Four choices were then presented and the children were asked to point to the card that matched the one previously presented. The total number of correct responses was scored.

Static analogy task. The procedures for this task were adapted from Goswami (5). Children were shown a clue word on an index card and told, "This is your clue word, your clue word is _." They were then asked to read six words: three that contained an orthographic sequence found in the clue word (analogous words) and three that had no commonalities with the clue word (non-analogous words). The six words were presented one at a time in random order. For example, for the clue word *unique*, the analogous words were *oblique*, *critique* and *mystique*. The non-analogous words were *serious*, *glacial* and *mirage*. A maximum score of 30 was possible. The complete list of words appears in Appendix A.

Dynamic analogy task. Because many of the children did not do well in the traditional static condition, a dynamic assessment of analogy abilities was also administered. This assessment consisted of five different levels of feedback or prompts to help the children perform better on the task. As with the static condition, the children were first read a clue word printed on an index card and asked to repeat it. The clue word, three analogous and three non-analogous words were then presented and the children were asked to select the words that were most like the clue word. This is considered to be Prompt 1. The four other prompt levels are described below.

Level 2. The words that the child read successfully were taken away. For the remaining words, the child was asked to find the part of the word that was similar to the clue word. If the child correctly identified the identical part of the word, the child was prompted with "So, if this says …, then what does this word say?" If the child could not identify the analogous aspect of the word, the examiner pointed to it and repeated the clue word.

Level 3. If the child was still unable to read the analogous words, the examiner read the clue word, asked the child to repeat it, and then read the first analogous word. The child was then asked to repeat the clue word and the first analogous word and then to read the two remaining analogous words.

Level 4. If the child was unable to read the two remaining analogous words, the examiner read the clue word and the first two analogous words. The child was then asked to repeat these words and attempted to read the one remaining analogous word.

Level 5. If the child was still unable to read the words, the examiner read all of the words for the child.

Scoring was based on the number of prompts the children needed to be able to read all of the analogous words. The maximum number of prompts was five.

Prompt 1: 3 × number of analogous words read correctly.
Prompt 2: 2.5 × number of analogous words read correctly.
Prompt 3: 2 × number of analogous words read correctly.
Prompt 4: 1 × number of analogous words read correctly.
Prompt 5: 0 points.

A total score of 54 was possible (18 words × 3).

Table 2. *Means and SDs for good and poor readers for static and dynamic analogy and phonological awareness tasks*

	Good readers ($n = 20$)	Poor readers ($n = 20$)
Static analogy	2.3 (2.1)	1.9 (1.8)
Dynamic analogy	34.2 (13.0)	29.0 (11.4)
Deletion	22.6 (3.7)	21.8 (6.8)
Segmentation	15.6 (4.5)	12.4 (7.7)

RESULTS

The first series of analyses compared the good and poor readers on the various measures of phonological awareness, visual memory, orthographic knowledge, and on the two analogy tasks (Table 2). The groups performed comparably on all of these measures. Thus, it was not surprising that no significant group differences were found. The largest mean difference occurred on the dynamic analogy task, but both groups showed highly variable performance on this task. The only significant group difference other than age and word attack skills occurred on the measure of the grammatical understanding subtest from the TOLD-P:III. (See Table 1.)

The second series of analyses used step-wise regression procedures to consider the relationship between the various measures and reading ability as measured by the Word Identification and Word Attack subtests from the WRMT-R. The first analysis examined these relationships with the two groups combined. Four measures significantly contributed to word identification. Performance on the static analogy task accounted for 42% of the variance. The orthographic (9%), visual memory (7%) and segmentation (6%) tasks accounted for an additional 22% of the variance. A total of 64% of the variance was thus accounted for by these four measures. The static analogy task was also the best predictor of word attack skills, but in this case it only accounted for 26% of the variance. Age added an additional 14% and performance on the TONI-2 another 7%, meaning that less than half of the variance (47%) was accounted for by these three measures.

When the good readers were considered separately, the static analogy task was the only significant predictor of word identification, accounting for 49% of the variance. Performance on the letter identification task was the best predictor of word attack skills, accounting for 31% of the variance. The deletion task accounted for another 26% of the variance. Without letter identification, the static analogy measure was the best predictor of word attack, but it accounted for only 29% of the variance.

When the poor readers were considered separately, the pattern of findings was somewhat different. Performance on the dynamic analogy task was the best predictor of word identification, accounting for 36% of the variance when the TONI-2 and language measures were not included in the analysis. Performance on the static analogy task accounted for an additional 20% of the variance. Orthographic knowledge and segmentation ability added an additional 21%. These four measures thus accounted for almost 80% of the variance on word identification. When the TONI-2 and the language measures were included in the analyses, the dynamic measure again accounted for 36% of the variance. The TONI-2 replaced the static analogy task as the second best predictor, adding 21% of the variance. The static analogy and orthographic tasks added an additional 20% of the variance.

When word attack skills were considered, the static analogy task was the best predictor, accounting for 24% of the variance. The segmentation task accounted for an additional 18% of the variance. When the TONI-2 and the language measures were included in the analyses, the composite measure of syntax from the TOLD-P:III was the only one that significantly contributed to word attack skills, accounting for 30% of the variance. The regression analyses appear in Appendix B.

DISCUSSION

Consistent with our initial hypotheses, the ability to use analogies did make a significant contribution to second grade reading ability. Although children in both groups performed poorly on the static analogy task, this measure was the best predictor of word recognition abilities when the data for the good and poor readers were considered together. When the two groups were considered separately, the static measure was the best predictor of word identification for the good readers and word attack for the poor readers. Letter identification was the best predictor of word identification for the good readers. (The poor readers had perfect scores on the letter identification task.) Letter identification is often viewed as being less important to reading than phonological knowledge. There is a body of literature, however, that emphasizes the importance of letter identification abilities for early reading (cf. Adams (1)). Of particular interest in the present study was whether analogy abilities would contribute to early reading as much as phonological awareness. To address this question, a regression analysis was performed without the measure of letter identification. This analysis revealed that the static

analogy task was the best predictor of word attack skills. For the poor readers, the dynamic analogy measure was the best predictor of word identification.

The strong relationship between the analogy measures and reading is mitigated considerably by the poor performance of both groups on the static analogy task. Children reading at the second grade level evidently have considerable difficulty using analogies to read unfamiliar words. It may be that children's unfamiliarity with the meaning of many of the words made the task too difficult. In the previous studies by Goswami (5), the words used were within the vocabulary level of first grade children. Thus, although the children could not read the words, they were familiar with them. In order to find words that second grade children could not read, it was often necessary to choose words that children had not heard of before.

We had thought that the dynamic analogy measure would significantly differentiate the good and the poor readers. Although the good readers did obtain a higher mean score on this task than the poor readers (34.2/29.0), the difference was not significant because of the large within-group variability. Given the greater range of scores, one would also have thought that the dynamic measure would have been a better predictor of reading than the static one. The dynamic measure was the best predictor of word identification skills in the poor readers, but this was the only instance in which it was a better predictor of reading than the static measure. It was unclear why the dynamic measure was related to word identification skills and not word attack skills. It would have made more sense for the dynamic measure to be related to word attack skills, given that both tasks reflect the ability to decode novel words.

In considering the relationship between word attack skills and the dynamic analogy task, one might be struck with the similarities between a traditional word attack measure and both analogy tasks. Although the analogy tasks purportedly measure children's ability to use analogies, they are also measures of phonological decoding ability. Given the complexity of the words in this study, it would be difficult to decode one of the novel words simply by noticing the analogous part of the word. Some phonological decoding is necessary to read the other part of the word. For example, a child might recognize that *unique* and *mystique* both have the same sequence of letters but not be able to decode the first part of the word *mystique*. The difficulty children have on this task thus could be the result of deficient decoding or analogy abilities or a combination of both. These points do not necessarily reduce the role that using analogies plays in learning to read. Instead, they remind us that it is difficult to isolate the use of analogies from basic phonological decoding abilities.

OTHER CONTRIBUTIONS TO WORD RECOGNITION

Importantly, the analogy measures were not the only ones that contributed to word recognition abilities. The grammatical understanding measure from the TOLD-P:III was the best predictor of word attack skills in the poor readers. No other measure significantly contributed to word attack performance when the language measures were included. This finding supports recent studies showing that language abilities may play a more important role in learning to read than was previously thought (4).

Cognitive abilities, as measured by the TONI-2, also contributed to word attack abilities when the good and the poor readers were combined and were significantly related to word identification in the poor readers. There was not a significant relationship between the TONI-2 and the two analogy measures, indicating that different reasoning skills were being tapped by these measures. As noted above, the analogy tasks were essentially measures of novel word reading; therefore, it should not be too surprising that there was not a significant relationship between these tasks and the TONI-2.

WHY DID THE POOR READERS READ SO POORLY?

The findings in the present study might lead one to conclude that deficiencies in higher level language and reasoning skills were primarily responsible for these children's poor reading abilities. Performance on the analogy tasks and the syntactic component of the TOLD-P:III were the best predictors of word recognition abilities. But it is important to remember that there were no group differences for either analogy task, whereas the good readers did perform significantly better on the grammatical understanding subtest from the TOLD-P:III. One interpretation of this pattern of findings is that poor readers may rely more on analogical reasoning abilities than good readers for word recognition because their phonological and language knowledge are deficient. This might explain how good and poor readers achieved similar word identification scores, but it does not explain the poor readers' limited word attack skills. The ability to achieve fairly high levels of performance on measures of phonological awareness apparently does not result in comparable levels of word attack ability. These poor readers evidently have limited knowledge of sound–letter correspondence rules or have the knowledge but have difficulty applying it when asked to read novel words.

THE PATH TO PROFICIENT WORD RECOGNITION

The development of proficient word recognition skills is characterized by the use of letter sequences and spelling patterns to visually recognize words without phonological conversion. The ability to use a direct visual route without phonological mediation to access semantic memory and word meaning is crucial for developing automatic word recognition skills. Share and Stanovich (10) recently proposed that children essentially teach themselves to read by using phonological information to construct orthographic representations of words. They emphasized the crucial role that phonological decoding plays in the self-teaching mechanism.

The findings of the present study suggest that the ability to make analogies may also be an important component of the self-teaching mechanism of children who are developing normally as well as of those who are having difficulty learning to read. Although phonological knowledge is crucial for developing automatic word recognition skills, children become proficient decoders by recognizing similarities between new and familiar words. The alternative is to have someone else point out the similarities, as we did in the dynamic analogy task. Phonological decoding and use of analogies to recognize novel words are thus tools that children use to become proficient readers. The paradox of proficient reading is that as children become more proficient readers, they use these tools less and less. Educators need perhaps to provide some formal instruction on how to become less reliant on these tools to read.

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APPENDIX A: STIMULUS WORDS

Clue words	Analogous words
1. Unique	mystique, oblique, critique, clinique
2. Luxurious	serious, glorious, curious, vicarious, precarious, hilarious, victorious
3. Gristle	jostle, bristle, bustle, wrestle, trestle
4. Facial	glacial, crucial, commercial, financial, social, judicial, artificial
5. Gracious	precious, vicious, delicious, suspicious, conscious
6. Massage	corsage, mirage, montage, menage, sabotage, camouflage, fuselage

APPENDIX B: REGRESSION ANALYSES

Good and poor readers	R^2
Word identification	
Static analogy	0.42
Orthographic	0.51
Visual	0.58
Segmentation	0.64
Word attack	
Static analogy	0.26
Age	0.40
TONI-2	0.47

Good readers	R^2
Word identification	
Static analogy	0.49
Word attack	
Letter identification	0.31
Deletion	0.57

Poor readers	R^2
Word identification	
Dynamic analogy	0.36
Static analogy	0.56
Orthographic	0.69
Segmentation	0.77
Word identification with TONI-2 and language measures	
Dynamic analogy	0.36
TONI-2	0.61
Static analogy	0.70
Orthographic	0.78
Word attack	
Static analogy	0.24
Segmentation	0.42
Word attack with TONI-2 and language measures	
Grammatical understanding	0.30

SAMMANFATTNING

Användandet av analogier vid läsinlärning

Artikeln handlar om i vilken utsträckning yngre läsare använder sig av s.k. ortografiska analogier vid ordavkodning. Med ortografiska analogier menas att utifrån ett känt ords stavning och uttal dra slutsatser om hur ett okänt ord med snarlik stavning skall uttalas. (Detta är givetvis mer relevant för engelsk ordavkodning än för svensk.) Förmåga att använda sig av sådana analogier anses bidra till att automatisera ordavkodningen.

I undersökningen ingick 20 normalläsande elever från åk 2 och 20 dåliga läsare från åk 3 och 4. Deltagarna var matchade på ett ordigenkänningstest. För att kvalificera sig som dålig läsare måste man ligga under en viss nivå på läsning av non-ord (word attack test) samt inte klara av något av de ord som fanns i analogitestet (se Appendix A). Alla deltagare presterade normalt på ett icke-verbalt intelligenstest (tabell 1).

I analogitestet gällde det att läsa upp ord, där somliga, men inte alla, hade samma uttal som ett målord man fått uppläst, dels utan hjälp (statiskt test), dels med hjälp (dynamiskt test). Samtidigt med analogitestningarna prövades även samtliga barns ortografiska kunskap, deras fonologiska medvetenhet samt visuella minne.

Resultaten visade inga signifikanta skillnader mellan grupperna (tabell 2). Det statiska analogitestet förklarade mest av variansen på ordigenkänningstestet (på vilket deltagarna var matchade), liksom på läsning av non-ord, men i lägre utsträckning. Detta gällde när grupperna var sammanslagna. I gruppen *goda* läsare förklarade det statiska analogitestet 49% av ordigenkänningen, medan bokstavsidentifiering och fonologisk medvetenhet (fonemdeletion) bäst förklarade läsning av non-ord. I gruppen *dåliga* läsare förutsa det dynamiska testet ordigenkänningen bäst, medan det statiska analogitestet bäst förutsa läsning av non-ord (se Appendix B).

YHTEENVETO

Analogioiden käyttö lukemisen oppimisessa

Kirjoituksessa pohditaan missä määrin nuoret lukijat käyttävät ns. ortografisia analogioita sanojen äännetason analyysissä. Englanninkielisessä ympäristössä tällä on suuri merkitys sanojen dekoodausprosessin automatisoinnissa.

Tutkittiin 20 hyvää toisluokkalaista ja 20 huonoa kolmas- ja neljäsluokkalaista lukijaa. Ryhmät tasattiin sanantunnistus testin perusteella. Ryhmittely perustui testeihin, jotka ovat nähtävissä liitteessä (Appendix A). Kaikilla lapsilla ei-kielellinen ÄO oli normaalin rajoissa.

Analogiatestaus tehtiin luettelemalla sanoja, joille tuli etsiä samoin äännettävä pari. Lasta joko ei autettu (staattinen osuus) tai autettiin (dynamminen osuus). Samalla testattiin oikeinkirjoitustaidot, fonologinen tietoisuus ja näkömuisti.

Tulokset eivät poikenneet ryhmien välillä (taulukko 2). Analogiatestin staattisen osan tulokset korreloivat sanojen tunnistuksen kanssa sekä epäsanojen luennan kanssa koko ryhmässä ($n = 40$). Hyvien lukijoiden analogiatestitulos selitti 49% sanatunnistustestin variaatiosta ja fonologinen tietoisuus selitti parhaiten epäsanojen luennan tulosta. Huonojen lukijoiden ryhmässä analogiatestin dynaaminen osuus selitti sanojen tunnistusta parhaiten, kun taas staattinen osa ennusti epäsanojen luennan tasoa (ks. Appendix B).