

METACOGNITIVE ABILITIES IN WORD IDENTIFICATION AND  
READING COMPETENCE OF POOR READERS: A COMPARISON OF  
THE COGNITIVE AND METACOGNITIVE ABILITIES IN WORD  
IDENTIFICATION SUBSKILL PROFILES OF GOOD AND POOR  
READERS.

Susan Spedding  
Special Education Centre  
University of Newcastle  
N.S.W. 2308

Paper presented at the AARE Annual Conference  
University of Newcastle, Newcastle  
27 November © 1 December, 1994

**Abstract**

Cognitive and metacognitive processing in reading at the word level, has received little attention in the recent literature, although a substantial amount of research relating to reading comprehension exists. This paper reports on research into cognitive and metacognitive processes at the word level.

A new analytic strategy for comparing the cognitive and metacognitive profiles of children developing reading skills at different rates has been used: a regression based logic that is analogous to the reading@level match design, but one

without some of the methodological problems of that design. This method has been utilised to examine the reading subskill profiles of students in Grades 2 to 5 who are poor readers to determine whether these readers differ from competent readers or whether poor readers have the same subskill profiles but are lagging behind in the development of reading skills.

Using this design the reading subskill profiles of poor readers and competent readers were compared on a set of phonological processing and metacognitive

abilities in word identification tasks, using both a decoding level and a comprehension level match design.

Much research in recent years has been devoted to studying the cognitive and metacognitive processes that are necessary for competent reading. But while most research has focused on metacognitive factors related to reading comprehension competence (see review by Haller, Child & Walberg, 1988), an increasing volume of data indicates that the cognitive and metacognitive processes that support word identification are also significant explanatory factors for variations in reading competence, particularly in the case of beginning reading (Perfetti, 1984; Rack, Snowling & Olson, 1992; Stanovich, 1982, 1986). It is often at the word level that many poor readers experience difficulties (Perfetti, 1984; Stanovich, 1982, 1991; Stanovich & Siegel, 1994). An examination of the cognitive and metacognitive processes at the word level (including phonological processing and metacognitive processing in word identification) may provide some insight into the reading difficulties experienced by poor readers. In this study the preliminary findings regarding the reading subskill profiles of reading disabled and non-reading disabled students are examined and discussed, using a relatively new application

of the analytic  
strategy of regression analysis (Stanovich & Siegel, 1994).

Research attempting to determine the qualitative difference  
between poor  
readers and good readers has yielded mixed results. Empirically, some  
studies between  
dyslexics and competent readers have revealed similar processing  
profiles (eg., Bech  
& Harding, 1984; Treiman & Hirsch & Pasek, 1985) and differences (eg.,  
Bradley &  
Bryant, 1978; Kochnower, Richardson & DiBenedetto, 1983; Snowling,  
Stackhouse &  
Rack, 1986). Garden@variety comparisons have also both supported  
qualitative  
similarity (eg., Tredman & Stevenson, 1988; Taylor, Satz & Friel,  
1979) and  
differences (Jorm, Share, MacLean & Matthews, 1986; Silva, McGee &  
Williams,  
1985).

One reason for these conflicting results may lie in the research  
designs  
employed. Two designs have dominated the research: the reading@level  
(RL) match  
design and the garden@variety control design. The RL match design  
involves matching

an older group of dyslexic children with a younger group of nondyslexic  
children, then  
comparing the cognitive characteristics and reading sub@skills of the  
two groups. In the  
garden@variety control design, dyslexic children are matched with other  
children  
reading at the same level but who are not labelled dyslexic.

Two problems may be encountered in these designs. The first involves  
the  
definition of the groups involved ie., dyslexics and garden variety  
poor readers. Given  
the difficulty of identifying dyslexics using IQ (see Stanovich, 1991  
for a detailed  
discussion) and the difficulty in differentiating dyslexic and  
garden@variety poor  
readers, particularly in light of Stanovich's (1988) suggestion that  
due to the Matthew  
effects dyslexics may develop into garden@variety poor readers, it may  
be as  
Seidenberg, Bruck, Fornarolo & Backman (1986) suggest, that rather than

use terms

such as "reading disabled" and "dyslexic" which carry other connotations, we simply describe those at the lower end of the reading continuum as "very poor readers" (p.80).

A second problem in conceptualizing and testing the notion of qualitative differences is the difference in what researchers describe as reading level matches. Some investigations have matched children on word recognition skills, while others have matched children on reading comprehension skills (referred to as DL and CL match designs by Stanovich, Nathan & Zolman, 1988). Finally, some have matched children using a combination of both. Since results and interpretation may vary depending on how the matching is done, it is not surprising that conflicting results have been obtained. It would appear likely that an investigation of the differences between poor readers and competent readers matched firstly, for word recognition and secondly, for comprehension, may reveal some useful results.

If there is no qualitative difference between poor readers and competent readers on cognitive and metacognitive subskills that support reading, then there is little justification for adopting differing remedial approaches. On the other hand if differences are found between the two groups, remediation attempts will need to take these differences into account in order to be effective. These are some of the issues this project hopes to address.

### Methodology

The study reported here examined the reading related cognitive and

metacognitive subskills at the word level, of second to fifth grade students using both a comprehension (CL) and decoding level (DL) match design. A number of difficulties have been encountered when using these designs, including the possibility of regression artifacts, logistical problems in procuring enough matched subjects at any

one age level to ensure a powerful statistical test, and the restriction of studying matches at only one level. In order to overcome some of these problems a new analytic strategy has been used in this study ; that of the continuous framework of regression analysis. The application of this technique in this study will be described in more detail later.

This range of grade level (Years 2 to 5) was chosen because firstly, the reciprocal causal role between phonological processing and reading acquisition from preschool to Year 2 has been well established in the literature. Secondly, previous trialling indicates that children below Grade 2 would have difficulty with tasks assessing metacognitive abilities in word identification. Finally, by Year 5 automaticity of word recognition should have been acquired by all students. It should be possible to identify the developmental differences across grades and across groups (i.e. poor readers and good readers) in their acquisition of reading.

The design of the study is outlined briefly below.

#### 1. Subjects:

Subjects in this study were 512 students from Grade 2 (N=126, 61 males and 65 females), Grade 3 (N=135, 58 males and 77 females), Grade 4 (N=124, 62 males and 65 females) and Grade 5 (N=127, 59 males and 65 females). The students in the study included all of each grade level in four schools in N.S.W.. The schools included in the study were selected in an attempt to include students from a range of socioeconomic backgrounds, from differing school population size, and from both rural and urban settings.

#### 2. Assessment instruments:

Two measures of phonemic awareness were used in this study: Bruce's Phoneme Deletion Test (Bruce, 1984) and the Yopp@Singer Phoneme Segmentation Test (Yopp, 1988).

Metacognitive abilities in word identification were assessed using the five tasks

developed in an earlier study (Spedding, 1991; Spedding & Chan, 1991). The first task assesses word awareness, while the other four tasks examine the student's metacognitive abilities in the strategic use of four different cues to assist word

identification: phonological, orthographic, morphological and context cues (for a detailed description of these tasks, see Spedding and Chan, 1994). Performance on each task reflects the student's use of strategies, and their awareness and monitoring of the strategies used (referred to as justification in the results).

Reading competence was assessed using a pseudoword reading task, the StLucia Graded Word Reading Test, the Test of Reading Comprehension (TORCH) (for Grades 3, 4, and 5)) and the ACER Primary Reading Survey Tests (for Grades 2 and 3).

A further measure, that of speed of letter naming was included using the letter naming test in the Neale Analysis of Reading. This measure was included following the finding of Stanovich's (1988) study in which letter naming time was the only area of significant difference in a comparison of skilled third graders and less skilled fifth graders (using a CL match design).

### 3. Data collection procedures:

Apart from the TORCH, all tests were administered individually. Tests were administered in the same order for all subjects and within the same four week period for subjects in the same grade. All testing took place during a twelve week period.

### 4. Data analysis:

Regression analysis was used for between@reading@ability comparisons on the metacognitive ability measures. A brief description of the use of the continuous framework of regression analysis follows (see Stanovich and Siegel, 1994, for a more detailed description of this analysis).

## Results and Discussion

In this study the identification of differences in cognitive patterns among children differing in rate of progress (i.e. good and poor readers) has utilised the continuous framework of regression analysis (see Stanovich & Segal, 1994) in order to overcome some of the problems associated with traditional reading level match designs.

Within the sample described earlier two groups of readers were defined: (i) one consisting of children who were achieving normally for their age cohort (the Non-Reading Disabled group @ NRD), and (ii) a second group who were achieving below age for their age level (the Reading Disabled group @ RD). Employing the criterion variables described in the assessment tasks earlier, the performance of the two groups

were examined together in one regression analysis.

The criterion variable is regressed on, firstly, the St Lucia Reading Age level (thus removing the variance in the criterion variable that is associated with word recognition level). Subsequent to the St Lucia Reading Age, a contrast reflecting the group classification is entered into the equation: a contrast capturing the NRD versus RD comparison. To whatever extent the criterion variable is associated with group classification independent of word reading level it will be reflected in significant beta weights (and explained variance) for these contrasts. Alternatively, if performance on a variable tracks reading level then subject classification (RD or NRD) should not be a significant predictor once reading level has been partialled out. In other words, if a developmental lag rather than qualitative differences in reading related subskills characterises all poor readers, then once reading level is regressed out as a predictor of reading related cognitive subskills, subject categorisation should not predict additional variance in the criterion variable.

The initial analysis extracts all variance associated with the St Lucia Reading

Age, including the possibility of the linear, quadratic and cubic trends. This allows for the possibility that the relationship between reading age and the criterion variable is not linear but may be a quadratic or cubic trend. The contrast is then entered (reflecting the comparison between Rd and NRD children). Results consistent with a developmental lag model of reading acquisition would be indicated if significant variance was explained by the St Lucia Reading Age but not by the contrasts. Such a pattern would be consistent with the prediction of a developmental lag model that subject classification should be irrelevant once the reading level of the subject is taken into account. Conversely, if either of the contrasts is significant in the simultaneous equation from which the St Lucia Reading Age has been partialled out, then this would falsify the prediction of the developmental lag model by indicating that the criterion variable is associated with something more than reading level.

The same logic applies when using the comprehension level (CL) matched design.

The results of these analyses are summarised in Table 1.

#### Reading Level Match Comparisons

In analysing the results, the implications of the different matching

procedures must be taken into consideration. In the DL match design, younger competent readers are matched with older disabled readers on a lower order reading skill (i.e. word recognition). In the CL match design, however, younger competent readers are matched with older poor readers using a higher order reading skill (i.e. comprehension).

As may have therefore been anticipated, the RD children outperformed the NRD group on word identification on the St Lucia, a lower order skill, but the reverse occurred in the case of reading comprehension. It is likely that this

finding reflects the  
the greater exposure to print and longer reading experience of the  
older RD group as  
well as their tendency to rely on sight word identification due to poor  
phonological  
skills. The NRD group, however, performed better in reading  
comprehension, perhaps  
because they were better able to concentrate on the meaning@getting  
nature of  
reading while poor readers exhausted their cognitive processes in lower  
order skills.

As can be seen in Table 1, there was only one reading subskill in  
which there  
was a conflict of findings depending on the match used. This occurred  
in the case of  
Nonword reading, where the NRD group outperformed the RD group when  
matched  
on word identification level, but were outperformed by the older poor  
readers when  
matched on comprehension level. In the DL match, younger competent  
readers of the  
same decoding level ability outperformed the older poor readers. As  
previously  
indicated, there is much evidence available which indicates that poor  
readers have  
difficulty in identifying nonwords due to their poor phonological  
processing abilities. In  
the CL match design the older poor readers outperformed the younger  
group of  
competent readers. This group of older readers, having been matched on  
comprehension level (a higher order processing skill) could be expected  
to have better word identification skills than the younger  
group in order to attain a similiar  
level of reading comprehension. This is shown to actually be the case,  
as in Table 1 it  
can be seen that the poor readers, when matched on comprehension level,  
outperformed the competent readers on word identification (St Lucia).

The finding that there was no difference between the RD and NRD using  
a  
DL match design, while the RD group outperformed the NRD group on the  
Phoneme Deletion Task using the CL match design may be a result of both  
the match  
design and the requirements of the task itself. This task requires the  
child to hold a  
word in memory, to remove a given phoneme from the word, and to  
pronounce the

new word. the ability of older readers, although reading disabled, may have gained an advantage from their experience with encoding. The reverse may well have occurred in the case of Phoneme segmentation, since a confusion between spelling a given word and identifying the sounds heard when the word is pronounced caused considerable difficulty for some older students.

Results on the use and justification of orthographic cues would tend to support the hypothesis that a different balance of phonological and orthographic skills characterises children with reading disabilities when compared to non-disabled readers. In the DL match design the difference between the two groups was not significant, while in the CL match design the RD group outperformed the NRD group. It may be that the reading disabled group have developed compensatory abilities in the use of orthographic skills to compensate for poor phonological skills. It could also be that orthographic skills are less impaired in poor readers than are phonological skills, or even that, because of a greater exposure to print and greater reading experience, the older poor readers have attained a greater store of orthographic representations than have younger non-disabled readers.

It is also likely that, in the case of morphological clues, older readers have a greater knowledge of word parts, root words, suffixes and prefixes, than do younger readers who have had less experience with reading and less instruction.

The finding that, overall, the RD group outperformed the NRD group on the metacognitive abilities in word identification tasks may reflect an advantage older children have in understanding the demands of the task and in being better able to verbalise and explain their actions. Previous research has indicated that poor readers are less aware of task demands and are less likely to monitor their use of strategies than are their same age peers who are competent readers (Spedding, 1991; Spedding

& Chan, 1991; Spedding & Chan, 1994). In this case, the difference in age may help to account for the result.

The ability of the older poor readers to outperform the good readers in the CL match design reflects the findings of Stanovich (1988), in which it was found that letter naming speed tracks chronological age rather than reading ability.

In conclusion, the finding that in many instances, once the contribution of either the St Lucia Reading Age level (in the case of DL matches) or the TORCH Adjusted Score level (in the CL matches) had been partialled out, there still remained contrasts between the RD and NRD groups which were significant, would tend to suggest that the developmental lag hypothesis is not a sufficient explanation for the differences which exist between good and poor readers.

According to Siegal (1992) and Stanovich (1988), the phonological core variable difference model of reading ability reflects a critical deficit in the phonological domain for reading disabled children, impairing the word recognition process. A considerable amount of research supports this conclusion (e.g. Brady & Shankweiler, 1991; Goswami & Bryant, 1990; Perfetti, 1985; Snowling, 1991). The findings of this study provide additional evidence that this is indeed the case.

The differences in the cognitive and metacognitive subskill profiles of these two groups warrant further consideration and investigation, particularly when addressing the issue of remediation strategies for poor readers.

Table 1. Summary of Results Showing the Differences Between the RD and NRD Groups Using a DL and CL Match Design

Group	DL Match	CL Match
differences		

Nodifference	PhonemeDeletion	Phoneme Segmentation
	Use of phonic cues	
	Justificationof phonic cues	Justification of phonic cues
	Use of orthographic cues	
	Justification of orthographic cues	
	Letternaming time	
	Letternaming accuracy	Letternaming accuracy
NRD > RD	Phoneme Segmentation	
	Nonword Reading	
	TORCH	
RD > NRD		Phoneme Deletion
		Nonword Reading
		St Lucia
	Word awareness	Word awareness
		Use of phonic cues
		Use of orthographic
		cues
		Just. of orth.cues
	Use of morphological cues	Use of morph.cues
	Just.of morphological cues	Just. of morph.cues
	Use of context cues	Use of context cues
	Justification of context cues	Just. of context cues
		Letternaming time

## References

- Beech, J.R. & Harding, L. (1984). Phonemic processing and the poor reader from a developmental lag viewpoint. *Reading Research Quarterly*, 19, 357-366.
- Bradley, L. & Bryant, P.E. (1978). Difficulties in auditory organisation as a possible cause of reading backwards. *Nature*, 271, 746-747.
- Brady, S.A. & Shankweiler, D.P.(Eds.). (1991). *Phonological processes in literacy*. Hillsdale, N.J.: Erlbaum.
- Bruce, D. (1984). *An analysis of word sounds by young children*.

British Journal of Educational Psychology, 35, 345-367.

Goswami, U. & Bryant, P.E. (1990). Phonological skills and learning to read. Hillsdale, N.J.: Erlbaum.

Haller, E.P., Child, D.A. & Walberg, H.J. (1988). Can comprehension be taught? A qualitative synthesis of "metacognitive" studies. Educational Researcher, 17(9), 5-8.

Jorm, A., Share, D., MacLean, R. & Matthews, R. (1986). Cognitive factors at school entry predictive of specific reading retardation and general reading backwardness: A research note. Journal of Child Psychology and Psychiatry, 27, 45-54.

Kochner, J., Richardson, E. & DiBenedetto, B. (1983). A comparison of the phonic decoding ability of normal and learning disabled children. Journal of Learning Disabilities, 16, 348-351.

Perfetti, C.A. (1984). Reading acquisition and beyond: Decoding includes cognition. American Journal of Education, 33, 40-61.

Perfetti, C.A. (1985). Reading ability. New York: Oxford University Press.

Rack, J.P., Snowling, M.J. & Olson, R.K. (1992). The nonword reading deficit in developmental dyslexia: A review. Reading Research Quarterly, 27(1), 29-53.

Seidenberg, M.S., Bruck, M., Fornarolo, G. & Backman, J. (1986). Who is dyslexic? Reply to Wolf. Applied Psycholinguistics, 7, 77-84.

Seigel, L.S. (1992). An evaluation of the discrepancy definition of learning disabilities. The Journal of Learning Disabilities, 25, 618-629.

Silva, P.A., McGee, R. & Williams, S. (1985). Some characteristics of 9-year-old boys with general reading

backwardness or specific reading retardation. Journal of Child Psychology and Psychiatry, 26, 407-421.

Snowling, M. (1991). Developmental reading disorders. Journal of Child Psychology and Psychiatry, 32, 49-77.

Snowling, M., Stackhouse, J. & Rack, J.P. (1986). Phonological dyslexia and dysgraphia: A developmental analysis. Cognitive Neuropsychology, 3, 309-339.

- Spedding, S.F. (1991). Metacognitive abilities in word identification and its relationship with reading competence. Unpublished Masters Thesis, University of Newcastle, Newcastle, N.S.W.
- Spedding, S.F. & Chan, L.K.S. (1991). Metacognitive abilities in word identification and its relationship with reading competence. Paper presented at the AARE Annual Conference, Gold Coast, Queensland, November 1991.
- Spedding, S. & Chan, L.K.S. (1994). Metacognitive abilities in word identification: assessment and instruction. *Australian Journal of Remedial Education*, 26(3), 80-12.
- Stanovich, K.E. (1982). Individual differences in the cognitive processes in reading: 1. Word decoding. *Journal of Learning Disabilities*, 15, 485-493.
- Stanovich, K.E. (1986). Matthew effects in reading: Some consequences of individual differences. *Reading Research Quarterly*, 21(4), 360-407.
- Stanovich, K.E. (1988). Speculations on the cause and consequences of individual differences in early reading acquisition. In P. Gough, (ed.). *Reading acquisition*. Hillsdale, N.J.: Erlbaum.
- Stanovich, K.E. (1991). Discrepancy definitions of reading disability: Has intelligence led us astray? *Reading Research Quarterly*, 26(1), 70-29.
- Stanovich, K.E., Nathan, R.G. & Zolman, T. (1988). The developmental lag hypothesis of reading: Longitudinal and matched reading level comparisons. *Child Development*, 71-86.
- Stanovich, K.E. & Siegel, L.S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of the phonological core variable difference model. *Journal of Educational Psychology*, 86(1), 24-53.
- Taylor, H.J., Satz, P. & Freil, J. (1979). Developmental dyslexia in relation to childhood reading disorders: Significance, clinical utility. *Reading Research Quarterly*, 84-101.
- Treiman, R. & Hirsch-Pasek, N. (1985). Are there qualitative differences in reading behaviour between dyslexics and normal readers? *Memory and Cognition*, 13, 357-364.
- Yopp, H.K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly*, 23(2), 159-177.

