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Prediction of poor and superior word reading

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Introduction

Early reading development is crucial for a child's future reading development and lifetime habit of reading. In a longitudinal study Cunningham and Stanovich followed a group of children from the first grade until the 11th grade (Cunningham & Stanovich 1997). They found that first grade reading ability predicted both reading comprehension and willingness to read for at least ten years. This study underlines the importance of becoming a good reader at an early age. But to be able to identify the children at-risk for reading failure, the early precursors of reading difficulties need to be found.

The search for early precursors of reading difficulties has provided a lot of longitudinal studies (for a review see Scarborough 1998). Scarborough notes that early reading ability in itself is the best predictor of reading ability later on. The more closely a skill being measured is related to reading, the stronger is its relation to future reading development. Letter knowledge is the skill that is the strongest predictor of reading ability later on. Twenty-four of the studies in Scarborough's overview included letter knowledge in their test battery. The mean correlation between letter knowledge and reading development in these studies is 0.52 (SD = 0.14). If only one measurement is to be used in screening children for those at-risk for reading failure, letter knowledge would be the best choice. However, letter knowledge training does not seem to be an effective way to prevent reading failure (Ehri 1983). As stated by Adams 1990, lack of letter knowledge is a symptom rather than a cause of reading difficulties.

Another area of importance to reading development is the child's phonological processing abilities. "In the strictest sense, phonological processing abilities refers to the perception, storage, retrieval and manipulation of the sounds of the language during acquisition, comprehension and production of both spoken and written codes. These abilities typically operate in an automatic fashion, as in online speech perception of production, but skilled language users develop the ability to reflect on and manipulate speech sounds at a more consciously controlled level (i.e., phonological awareness)." (Catts et al. 1999, p. 332).

These phonological processing abilities are divided by Wagner & Torgesen 1987 into three main areas, namely phonological awareness, phonological coding in lexical access, and phonetic recoding to maintain information in working memory. A lot of studies have indicated that there is a strong relationship between these phonological processing abilities and reading development. (For reviews see Elbro 1996, Torgesen et al. 1994.)

Phonetic recoding to maintain information in working memory is usually measured by tasks that require short storage of and sometimes manipulation with verbal items such as digits, words or non-words. Using a non-word repetition task, Stone & Brady 1995 found that poor readers had poorer non-word repetition than reading age matched younger. Other studies have also found consistent differences between good and poor readers' memories for digits, letters and words (for a review see McDougall & Hulme 1994). In a study with 4- and 5-year-old children, Gathercole et al. 1991 found that phonological memory was significantly related to reading achievement among the oldest but not among the youngest children. This leads Gathercole et al. to conclude that phonological memory might be of greater importance at a specific time in the reading development, namely the time when children are beginning to use an alphabetic strategy in their decoding. Phonological memory therefore might be of greater importance in early reading development for the best readers among the children because they relatively quickly begin to decode by giving each letter a sound.

Phonological coding in lexical access is a measure of how efficient phonological information is retrieved from the mental lexicon. Different kinds of naming tasks have been used to assess children's phonological coding in lexical access. The contribution of this ability to the explanation of variation in reading ability has not been quite clear. Wagner et al. 1994 have found that rapid automatized naming did not explain any additional variance in reading ability when phoneme awareness is entered simultaneously. The results are the same when they only look at the poor readers in the sample. Meyer et al. 1998 provide a study with older children. They try to predict word reading in the fifth and the eighth grade from reading and rapid naming in the third grade. They have found that after controlling for reading ability in the third grade rapid naming only had significant predictive value in a sample of poor readers, not in a random sample. The results from Meyer's study might indicate that rapid naming is a more important predictor when predicting poor reading than when predicting reading ability in general.

Phonological awareness is the most investigated of the three phonological processing abilities. A lot of longitudinal studies have shown that phoneme awareness is an important predictor of reading ability (for a review see Elbro 1996). In the longitudinal study by Wagner et al. 1994 phonological awareness was the only one of the three phonological processing abilities that remains significant when entered together with phonological memory and rapid naming. Torgesen et al. 1997 found that phonological awareness is important not only when predicting reading growth from the third to the fifth grade in a random sample but also in a sample of poor readers. So phonological awareness seems to be important both when predicting reading ability and reading difficulty.

Training studies have shown that an effective way to prevent reading failure is by training phonological awareness in kindergarten (Lundberg et al. 1988, Ball & Blachmann 1991).

Results from longitudinal studies and training studies indicate that there is a causal relationship between phonological awareness and reading development. Therefore a relevant question to ask is what is important for the development of phonological awareness. Recently several researchers have hypothesized that the quality of the phonological representations in the mental lexicon might be an important factor in the development of phonological awareness (Fowler 1991, Elbro 1996, Swan & Goswami 1997). If the child's phonological representations are stored indistinctly in the mental lexicon, it will be more difficult to perform well on measures of phonological awareness and perhaps also on working memory tasks and naming tasks.

In most longitudinal studies, the main aim has been to identify children at-risk for reading disabilities as early as possible. These studies have provided a lot of knowledge about the different language abilities that reading skills depend upon. From a preventive point of view it is understandable that the focus has been on the poor readers. But in order to understand the importance of different sub-skills in the reading process, it is also of interest to have a closer look at the children who are the best readers in the early grades. How are their skills? Do they have extremely good phonological processing skills on all areas, or is it certain language skills that make the difference between an average reader and a superior reader?

The main aim of this paper is to compare the strongest predictors of poor and superior reading. The hypothesis is that different language measures are the strongest predictors of very poor and superior reading.

Phonological awareness has turned out to be an important predictor of both reading ability in general and reading disability. Therefore the hypothesis is that phonological awareness is an important predictor of both poor and superior reading ability.

Distinctness of phonological representations has not been included in other longitudinal studies yet. The hypothesis is that this distinctness will be more important when predicting poor reading than when predicting superior reading. When you have reached a certain level of distinctness, it is sufficient for the further development of phonological awareness and reading acquisition, with other skills becoming decisive for whether a child will be an average reader or a superior reader. These other skills might be more advanced phoneme awareness, and more efficient storage of the phonological representations in short-term memory. Efficient short- and long-term memory storage of the letter-sound relations makes it possible to use the mental resources for the ongoing development of the decoding process.

Naming is hypothesized to be of greater importance when predicting poor reading than when predicting superior reading.

Method

Subjects

Subjects for the study were children of dyslexic parents and children of normally reading parents. This paper reports on the results from the test sessions at the beginning of kindergarten and at the beginning of the second grade.

A total of 104 children were included in the study. There were 51 children of dyslexic parents and 53 children of normally reading parents. There were 57 girls and 46 boys in the study (for further description of the children in the study see Elbro et al. 1998).

Language measures at the beginning of kindergarten

The test battery included many different language measures at the beginning of kindergarten. The description of the language measures is divided into four main areas namely: linguistic awareness, basic language abilities, phonological representations and basic cognitive abilities.

Linguistic awareness. Linguistic awareness has turned out to be an important predictor of reading development in other studies (Scarborough 1998). In this battery of tests, different linguistic segments were included. A test of the child's implicit knowledge of morphology was included making it possible to see whether the child's knowledge of morphology could explain some variance in reading ability that was not explained by phonological measures.

Deletion task. This task was inspired by Catts 1991. The child was asked to take away the first part of a word. There were six items where the child was to delete the first morpheme in a compound, six items where the child was to delete the first syllable, and finally eight items where the child was to delete the first phoneme. The remainder was a real word in all conditions.

Identification task. In this task, the experimenter said the first syllable or phoneme of a word. The task for the child was to find the word that started with this syllable or phoneme among six pictures. There were eight syllable items and eight phoneme items.

Inflection and compound formation with new words. This task was a Danish version of Berko's wug-test (Berko 1958) that has previously been used in another Danish research project (Elbro 1990). It is a test of the child's knowledge of morphology. The items are illustrated with pictures of invented animals. In the inflection items, the child was given the label of an invented animal and asked what he or she would call them when there were two animals. In the compound items, the child was asked to make a label for an invented animal that was good at doing a particular invented thing.

Basic language abilities. This section contained tests of more basic language abilities. The tests in this section dealt with input, storage and output of phonological material. These measures were included in this study to see whether e.g. poor phoneme awareness is a consequence of problems with more basic automatized phonological processing such as phoneme discrimination or articulatory accuracy.

Phoneme discrimination. For assessing the child's phoneme discrimination we used a modified version of a Danish discrimination test (Kjær 1977). In the test, the child was to discriminate between pairs of words that only differed by one sound, for example 'hat' and 'cat'. In the modified version of the test, the words were tape recorded with the background noise of 12 female voices speaking simultaneously. The tape was played to the child and the child was to point at the picture that represented the word.

Phonological short term memory. We used the digit span from WISC-R (Wechsler 1974). We revised the test and added an extra easy level with two digits. The score used was a total score for the forwards and backward condition.

Articulatory accuracy and efficiency. In this test, the child was asked to repeat three different strings of nonsense syllables, for example 'da-sa-na'. The child was at first asked to repeat the syllables slowly to make sure that the child could pronounce the syllables correctly. The child was then asked to repeat the string of nonsense syllables ten times as quickly and correctly as possible.

Phonological representations. In order to assess the child's phonological representation, a naming task and a distinct pronunciation task was included.

Picture naming. This test was included to assess how efficient the child's retrieval of phonological representations was. It was a simple naming task with pictures from a child's lotto. The child was asked to name the pictures as quickly and correctly as possible, so the score was a combined accuracy and speed score.

Phonological distinctness. This test was designed to obtain the child's most distinct pronunciation of a word. This was done by means of a hand-held puppet that did not pronounce words very well, and the child was supposed to teach the puppet the most distinct pronunciation of a word.

Two different scores were computed on the basis of this task, an accuracy score and a distinctness score. The accuracy score was the percentage of words that were pronounced correctly. If the child for example said [lobəˈti'w] instead of [logmoˈti'w] then it was scored as a pronunciation error.

The items where the children made pronunciation errors were not included in the distinctness score. The distinctness score focused on pronunciations of the vowels of the words. The most distinct form of *lokomotiv* would be [lokomoˈti'w] and a correct but more indistinct pronunciation could for example be [logmoˈti'w]. The distinctness score was the percentage of the selected vowels that were given a maximal distinct pronunciation.

Basic cognitive abilities. In the test battery two different tests of the children's basic cognitive abilities were included to see whether these measures could contribute in the prediction of superior or poor reading.

Receptive vocabulary. We used a Danish version of the Peabody Picture Vocabulary Test (Dunn and Dunn 1981). The test is not standardized in Danish so the raw scores were used in the analysis.

Nonverbal intelligence. For measuring nonverbal intelligence we used Raven's coloured matrices (Raven 1959).

Letter Knowledge. The child was asked to name as many uppercase letters as possible.

Family Background. While the only background variable used in this paper was dyslexia in the family, we had collected a lot of different background information on these children. For further description of these background factors and their importance as unique predictors of reading development see Elbro et al. 1998.

Reading measures at the beginning of the second grade

The reading measures from the beginning of second grade included here are two word-reading measures. (For a further description of the other reading measures see Petersen 2000.)

Oral word reading. The child was asked to read aloud a list of 30 words and 5 practice words. The 30 test words were presented on three pages in order of increasing degree of difficulty. The test was stopped if the child could not read any of the practice words correctly, or if the child could not read any of the words on a presented page correctly.

Silent word reading. In this silent reading task, OS400 (Søegård & Petersen 1974), the child was asked to find the picture that matched a word among four different pictures. The child was to read as many words as possible in 10 minutes.

A composite word reading score. The child's score on the oral word reading and the silent word reading were used to form a composite word reading score. This composite word reading score was obtained by adding half the standardized scores from each of the two tests of word reading.

Results

The language measures from kindergarten have been used to try to predict poor and superior reading on the composite word reading score in the second grade. The children were divided into reader groups on the basis of the standardized reading scores and the poor readers as well as the superior readers were compared to the rest of the children on the language measures from kindergarten.

Logistic regression analyses with backwards-stepwise selection were carried out to find the best predictors of poor and superior word reading (for further description of this procedure see Elbro et al. 1998). As a last step in these analyses, either dyslexia in the family, the child's sex, or letter knowledge was entered as the final variable to see whether this information had a significant predictive value even after controlling for the most important language measures in the prediction.

The best model for predicting poor word reading in the second grade was used to try to predict superior reading. Finally, the best model for predicting superior word reading was used to try to predict poor word reading.

Definition of the reader groups

Among the children of normally reading parents a cut off point was chosen that separated the 10% poorest word readers from the rest of the group. This cut off point was at approximately z = –1 (children scoring at least one standard deviation below the mean composite score). Children scoring below this point were categorized as poor readers. In Table 1 the raw scores and the number of children categorized as poor readers are displayed.

Table 1. Average and standard deviation, in parenthesis, of the raw scores on the different reading measures for the poor and superior readers.

	Poor readers	Superior readers	Total
Second grade word reading	N=23	N=23	N=104
oral word reading	1 (1.48)	24.96 (3.77)	10.86 (9.04)
silent word reading	23.00 (10.24)	142.74 (52.68)	67.48 (51.02)

In order to get a group of superior readers that matched the group of poor word readers in size, a cut off point was chosen. This cut off point was at approximately z = 1 (children scoring at least one standard deviation above the mean composite score). Children scoring above this point were categorized as superior word readers. In Table 1 the raw scores and the number of children categorized as superior readers on the different measures are displayed.

Table 2. Average and standard deviation, in parenthesis, on the kindergarten language measures for the children categorized as poor word readers in the beginning of the second grade and the rest of the children. One-way ANOVAs were carried out to compare the language abilities of the two groups of children. Asterisks in the first column of means indicate statistically significant differences between the poor word readers and the rest of the children. *$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Language abilities at the beginning of KG	The poor word readers (N=23)			The normal word readers (N=81)	
Linguistic awareness					
Morpheme deletion (max 6)	2.43	(2.13)	**	3.90	(2.20)
Syllable deletion (max 6)	1.61	(1.80)	*	2.68	(1.95)
Initial phon. deletion (max 9)	0.43	(0.79)		1.18	(1.81)
Syllable identification (max 8)	6.26	(1.18)	*	6.88	(1.11)
Phoneme identification (max 8)	3.35	(1.37)	**	4.64	(1.78)
Inflections/compound (max 18)	3.04	(2.14)	*	4.81	(3.11)
Basic Language abilities					
Phoneme discr. (max 102)	74.90	(6.75)	**	79.90	(6.87)
Phon. STM (WISC-R)	7.13	(2.26)	**	8.46	(1.99)
Artic. efficiency (OK/sec)	0.48	(0.37)		0.65	(0.41)
Phonological Representations					
Picture naming (OK/sec)	0.33	(0.10)	**	0.41	(0.11)
Pronuncation accuracy (%)	74.34	(19.53)	**	84.61	(13.42)
Distinctness (%)	53.00	(17.53)	***	62.74	(10.38)
Basic cognitive abilities					
Receptive vocabulary (PPVT)	66.83	(8.58)		69.04	(7.97)
Nonverbal (Raven max 36)	18.17	(4.42)		18.75	(4.05)

The poor reader's early language abilities in kindergarten

One-way ANOVAs were made to compare the early language abilities in kindergarten of the children categorized as poor word readers and the rest of the children. In Table 2 the results from ANOVAs for the poor word readers have been displayed. The poor word readers scored significantly worse on all language measures in kindergarten except for the basic cognitive abilities and the phoneme deletion task. The reason poor word readers did not score significantly worse on phoneme deletion might be a tendency to the general floor effect on the phoneme deletion task.

The poor word readers did not score significantly worse on the vocabulary test and the nonverbal IQ test, which indicated that the poor word readers did not have a vocabulary problem or a cognitive problem. Their language problems were related to the phonological processes.

Table 3. Average and standard deviation, in parenthesis, on the kindergarten language measures for the children categorized as superior word readers in the beginning of the second grade and the rest of the children. One-way ANOVAs were carried out to compare the language abilities of the two groups of children. Asterisks in the first column of means indicate statistically significant differences between the superior phonological coders and the rest of the children. *p < 0.05, ** p < 0.01, *** p <0.001.

Language abilities at the beginning of KG	The superior word readers (N=23)			The normal word readers (N=81)	
Linguistic awareness					
Morpheme deletion (max 6)	4.83	(1.75)	**	3.21	(2.27)
Syllable deletion (max 6)	3.52	(2.00)	**	2.13	(1.85)
Initial phon. deletion (max 9)	1.70	(2.20)	*	0.81	(1.43)
Syllable identification (max 8)	7.13	(0.87)		6.63	(1.19)
Phoneme identification (max 8)	5.39	(1.72)	***	4.05	(1.68)
Inflections/compound (max 18)	6.35	(3.02)	***	3.85	(2.77)
Basic Launguage abilities					
Phoneme discr. (max 102)	83.30	(4.45)	***	77.49	(7.24)
Phon. STM (WISC-R)	9.61	(1.85)	***	7.75	(2.01)
Artic. efficiency (OK/sec)	0.85	(0.36)	***	0.55	(0.39)
Phonological Representations					
Picture naming (OK/sec)	0.46	(0.13)	***	0.37	(0.10)
Pronuncation accuracy (%)	88.43	(10.06)	*	80.60	(16.36)
Distinctness (%)	63.24	(9.15)		59.79	(13.73)
Basic cognitive abilities					
Receptive vocabulary (PPVT)	72.13	(8.23)	*	67.51	(7.84)
Nonverbal (Raven max 36)	20.22	(3.87)	*	18.16	(4.10)

The superior reader's early language abilities in kindergarten

Again one way ANOVAs were made to compare the early language abilities in kindergarten of the children who were categorized as superior readers and the rest of the children. In Table 3 the results from ANOVAs for the superior word readers are displayed. They scored significantly better on all measures except for pronunciation distinctness and syllable identification. So the superior word readers had significantly better language abilities in almost every area.

Predicting word reading in the second grade

The best model for predicting poor word reading in the second grade after logistic regression with backwards-stepwise selection contained phoneme identification (Wald=3.67, $p < 0.05$), picture naming (Wald=5.53, $p < 0.05$), and distinctness of the phonological representations (Wald= 3.95, $p < 0.05$). This model had an overall prediction rate of 81%, meaning that 83 of the 104 children were categorized correctly as poor or normal word readers. However, the sensivity of the model was quite low. Only six of the 23 children (26%) who were poor word readers in the second grade were predicted to be so by the model.

After entering the language measures, which were the strongest predictors of poor word reading, either dyslexia in the family, the child's sex, or letter knowledge was entered as the final variable in separate analyses. Sex entered as the final variable did not reach significance, and dyslexia in the family entered as the final variable was only marginally significant (Wald= 3.26, $p < 0.1$). Only letter knowledge reached significance when entered after the language measures which were the strongest predictors of poor word reading (Wald = 7.71, $p < 0.01$), and adding letter knowledge to the model improved the sensivity of the model from 26% to 48%.

The best model for predicting superior word reading in the second grade after logistic regression analysis with backwards stepwise selection contained phoneme identification (Wald = 7.01, $p < 0.01$), phonological short-term memory (Wald = 7.14, $p < 0.01$), and phoneme discrimination (Wald = 5.70, $p < 0.05$). This model had an overall prediction rate of 85% and the sensivity of the model was better than for the model predicting poor word reading. Almost half of the superior readers, eleven out of 23 (48%), were predicted correctly by the model. Letter knowledge was a significant predictor when entered after the language measures that were the strongest predictors of superior word reading (Wald = 10.82, $p < 0.001$). And even when entered after letter knowledge and the most important language measures, sex was a significant predictor of superior word reading (Wald = 5.4, $p < 0.05$). Including letter knowledge and sex in the model improved the sensivity of the model from 48% to 65 %.

The model made to predict poor word reading was used to predict superior word reading. This resulted in significantly less sensivity (Chi-square = 4.85 , $p < 0.05$). Only four of the 23 superior readers (18%) were predicted to be superior readers by the model that contained phoneme identification, picture naming and distinctness of phonological representations. The language measures not included in the model were entered one by one to see which of these language measures were still significant after using the model. A lot of language measures were still significant: syllable deletion (Wald = 6.51, $p < 0.05$), phoneme discrimination (Wald =5.82, $p < 0.05$), phonological short-term memory (Wald = 10.39, $p < 0.001$), inflection and compound formation (Wald = 5.78, $p < 0.05$).

The model made to predict superior word reading was used to predict poor word reading. This did not result in significantly less sensivity (Chi-square=0.11, $p > 0.1$) than the original model. Only five of the 23 poor word readers (22%) were predicted to be poor readers by the model that contained phoneme deletion, phonological short term memory and phoneme discrimination. The language measures not included in the model were entered one by one to see which of these language measures were still significant after using the model. Only two of the language measures were significant after use of the model, namely picture naming (Wald = 4.36, $p < 0.05$) and distinctness of phonological representations (Wald = 3.92, $p < 0.05$).

Summary and Discussion

Generally it was easier to predict the superior readers than the poor readers. The sensivity of the models predicting superior word reading was better than for the models predicting poor word reading. The sensivity of the model predicting poor word reading was quite low.

The main aim of this study was to see whether different language measures predicted poor and superior word reading. As expected it was not quite the same language measures that predicted poor reading and superior reading. Awareness of phonemes was important both in the prediction of poor and superior word reading. The distinctness of phonological representations was a very strong predictor when predicting poor word reading but not when predicting superior word reading. This indicates that a certain level of distinctness is necessary for developing an effective decoding ability, but when you have reached this level other factors are decisive for whether a child becomes among the best readers.

It was hypothesized that the poor readers were characterized by having a non-efficient access to phonological representations in memory, and that the poor word readers therefore would be especially poor on timed measures such as picture naming. Picture naming turned out to be much more important when predicting poor word reading than when predicting superior

reading. These results are in accordance with the results of Meyer et al. 1998 who found that rapid naming tasks only had predictive power for prediction of reading ability among poor readers, not among a random sample of readers.

The superior readers turned out to have a more efficient storage of phonological information. Phonological short-term memory turned out to be a very strong predictor of superior word reading.

The superior readers in this study might not be as superior as if we had a random sample of children and this might be the cause of the picture of the differences between the strongest predictors of poor and superior reading being not quite clear. Half of the children in this study had dyslexic parents, and therefore the general reading level in this sample might be poorer than in a random sample. So there might have been fewer very superior word readers. But even though our group of superior readers might not be so superior, there were great differences in the reading level of the different groups of children, and on the children's early language abilities in the beginning of kindergarten.

Surprisingly, a child's gender turned out to be an important background variable to control for when predicting superior word reading, even after controlling for the language measures which were the strongest predictors of reading. Other studies have also found differences in reading ability between boys and girls (see for example Badian 1999), but these differences have been seen as a result of the girls' better language abilities from the beginning. But adding sex was still a significant predictor of superior word reading. One-way ANOVAs were carried out to compare boys' and girls' language abilities in kindergarten. In this study the boys did not score poorer than the girls did on the language measures. In fact the only significant differences between the boys and girls in the study were that the boys had a significantly higher score on vocabulary and nonverbal IQ at the beginning of kindergarten. So these results show that the poorer reading results for the boys in this study are not due to poorer language abilities. Perhaps early reading instruction is more appealing to the girls than to the boys, resulting in the girls reading a lot and getting a lot of training. In contrast, the boys read as little as possible and do not get enough training to break the code and later on automatize the decoding process.

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References

Adams, M. J. 1990. *Beginning to Read: Thinking and Learning about Print.* Cambridge: The MIT Press.

Badian, N. A. 1999. 'Persistent Arithmetic, Reading, or Arithmetic and Reading Disability.' *Annals of Dyslexia* 49, 45–70.

Ball, E. W. & B. A. Blachmann. 1991. 'Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling?' *Reading Research Quarterly*, 26, 49–66.

Berko, J. 1958. 'The child's learning of English morphology.' *Word* 14, 150–177.

Catts, H. W. 1991. 'Early Identification of Dyslexia: Evidence from a follow-up study of speech-language impaired children.' *Annals of Dyslexia*, 41, 163–177.

Catts, H. W., M. E. Fey, X. Zhang & J. B. Tomblin. 1999. 'Language Basis of Reading and Reading Disabilities: Evidence from a Longitudinal Investigation.' *Scientific Studies of Reading* 3, 331–361.

Cunningham, A. E & K. E. Stanovich. 1997. 'Early Reading Acquisition and Its Relation to Reading Experience and Ability 10 years later.' *Developmental Psychology* 33, 934–945.

Dunn, L. M. & L. M. Dunn. 1981. *Peabody Picture Vocabulary Test-revised.* Circle Pines, MN: American Guidance Service.

Ehri, L. 1983. 'A Critique of Five Studies Related to Letter-Name Knowledge and Learning to Read.' In L. M. Gentile, L. M. Kimil & J. S. Blanchard (eds.), *Reading Research Revised*, 143–153. Ohio: Columbus.

Elbro, C. 1990. *Differences in Dyslexia: A study of reading strategies in a linguistic perspective.* Copenhagen: Munksgaard.

Elbro, C. 1996. 'Early linguistic abilities and reading development: A review and a hypothesis about distinctness of phonological representations.' *Reading and Writing: An interdisciplinary Journal* 8, 453–485.

Elbro, C., I. Borström, & D. K. Petersen. 1998. 'Predicting dyslexia from kindergarten. The importance of phonological representations of lexical items.' *Reading Research Quarterly* 33, 36–57.

Fowler, A. 1991. 'How Early Phonological Development Might Set the Stage for Phoneme Awareness.' In S.A. Bradley & D.P. Shankweiler (eds.), *Phonological Processes in Literacy*, 97–117. Hillsdale, NJ: Lawrence Erlbaum.

Gathercole, S. E., C. Willis & A. Baddeley. 1991. 'Differentiating phonological memory and awareness of rhyme: Reading and vocabulary development in children.' *British Journal of Psychology* 82, 387–406.

Kjær, B. E. 1977. *BKS-testen. En test til undersøgelse af børns evne til auditiv diskrimination af enkeltlyd i vokalt præsenterede ordpar.* ('An auditory discrimination test of children's discrimination of single sounds in pairs of words'). Herning: Specialpædagogisk forlag.

Lundberg, I. J. Frost & O. Petersen. 1988. 'Effects of an extensive program for stimulating phonological awareness in preschool children.' *Reading Research Quarterly* 23, 263–284.

McDougall, S & C. Hulme. 1994. 'Short-term Memory, Speech Rate and Phonological Awareness as Predictors of Learning to Read.' In C. Hulme & M. Snowling (eds.), *Reading Development and Dyslexia*, 31–44. London: Whurr Publishers Ltd.

Meyer, M. S., F. B. Wood, L. A. Hart & R. H. Felton. 1998. 'Selective Predictive Value of Rapid Automatized Naming in Poor Readers.' *Journal of Learning Disabilities* 31, 106–117.

Petersen, D. K. 2000. 'What Do You Get if You Add /mmm/ to Ice? Training Phoneme Awareness in Kindergarten: An intervention Study with Children of Dyslexic Parents.' In N. Badian (ed.) *Prediction and Prevention of Reading Failure,* 249–275. Timonium: York Press, Inc.

Raven, J.C. 1959. *Coloured progressive matrices: Sets A, AB, B.* Oxford, England: Oxford Psychologists.

Scarborough, H. S. 1998. 'Early Identification of Children at Risk for Reading Disabilities. Phonological Awareness and Some Other Promising Predictors.' In B.K. Shapiro, J.A. Pasquale & A. J. Capute (eds.), *Specific Reading Disability. A View of the Spectrum*, 75–119. Timonium: York Press, Inc.

Stone, B. & S. Brady. 1995. 'Evidence for phonological processing deficits in less-skilled readers.' *Annals of Dyslexia* 45, 51–78.

Swan, D. & U. Goswami. 1997. 'Phonological Awareness Deficits in Developmental Dyslexia and the Phonological Representations Hypothesis.' *Journal of Experimental Child Psychology* 66, 18–41.

Søegård, A. & S. P. B. Petersen. 1974. *Ordstillelæsningsprøve OS400* ('Silent word reading test OS 400'). Copenhagen: Dansk psykologisk forlag.

Torgesen, J. K., R. K. Wagner & C. A. Rashotte. 1994. 'Longitudinal studies of Phonological Processing and Reading.' *Journal of Learning Disabilities* 27, 276–286.

Torgesen, J. K., R. K. Wagner, C. A. Rashotte, S. Burgess & S. Hecht. 1997. 'Contributions of Phonological Awareness and Rapid Automatic Naming Ability to the Growth of Word-Reading Skills in Second to Fifth Grade Children.' *Scientific Studies of Reading* 1, 161–185.

Wagner, R. K. & J. K. Torgesen. 1987. 'The nature of phonological processing and its causal role in the acquisition of reading skills.' *Psychological Bulletin* 101, 192–212.

Wagner, R. K., J. K. Torgesen & C. A. Rachotte. 1994. 'Development of reading-related phonological processing abilities: New evidence of bidirectional causality from a latent variable longitudinal study.' *Developmental Psychology* 30, 73–87.

Wechsler, D. 1974. *Wechsler intelligence scale for children, revised.* New York: Psychological Corporation.

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Who killed the young man? 15-year-olds' responses to a fable

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In 2000, more than 4000 Norwegian 15-year-olds participated in an international reading literacy survey, OECD PISA (Programme for International Student Assessment). OECD PISA is a new regular survey that assesses 15-year-olds' competence in three domains of literacy: reading literacy, mathematical literacy and scientific literacy. As reading was the main subject in 2000, it comprised 2/3 of the test material. In 2003, Mathematics will be the main subject and in 2006, it will be Science. The assessment was carried out in 32 countries during 2000, and around 100 000 15-year-olds participated.

In PISA *reading literacy* is to be understood in a broad sense rather than a technical sense. Technical skills like reading speed, and decoding of words and sentences are not tested, as 15-year-olds are considered to be able to read in a technical sense. Reading literacy here implies that readers should be able to construct, extend, and reflect on the meaning of what they have read across a wide range of texts associated with a variety of situations. The theory behind this reading framework is based on cognitive views of reading literacy, emphasising the interactive nature of reading and the constructive nature of comprehension (OECD PISA 1999). Reading is regarded as a process in which readers generate meaning in response to text by using their prior knowledge and understanding. It is implied that understanding a written text is more than just understanding the meaning of the words. Reading is the result of cognitive and verbal processes that are influenced by the reader, the context and the text itself. Readers will have different prior knowledge and experiences, and texts can affect different readers in different ways. Thus the process of reading and understanding becomes different from one reader to another (e.g. Fish 1987, Beach and Hynds 1991).