

What has recent research taught us about the causes and best instructional management of children with reading and spelling difficulties?

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Competing Theoretical Accounts

- Incomplete cerebral lateralisation (1930s)
 - Visual processing and memory deficits (1970s)
 - Phonological-core deficit hypothesis (1980s)
 - Double deficit hypothesis – phonological + naming speed deficits (1990s)
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Phonological Processing Deficits

Reading and spelling difficulties exist on the continuum of developmental language disorders. Primary weakness is in processing the phonological or speech sounds of the child's language.

Fundamental difficulties forming and maintaining distinct representations of speech sounds - "fuzzy", indistinct or unstable phonological codes (cognitive structures that aid in the perception and production of speech sounds).

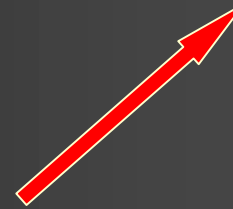
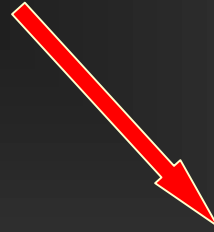


Difficulties establishing accurate and easily accessible links between written and spoken language ie "cracking the alphabetic code".

Input
(what's heard)



Output
(what's said)



Phonological Representation

whole word
syllable
onset-rime

phoneme

shallow levels - develop through
natural language experiences

deeper levels - develops through
exposure to instruction

Poorly specified phonological codes

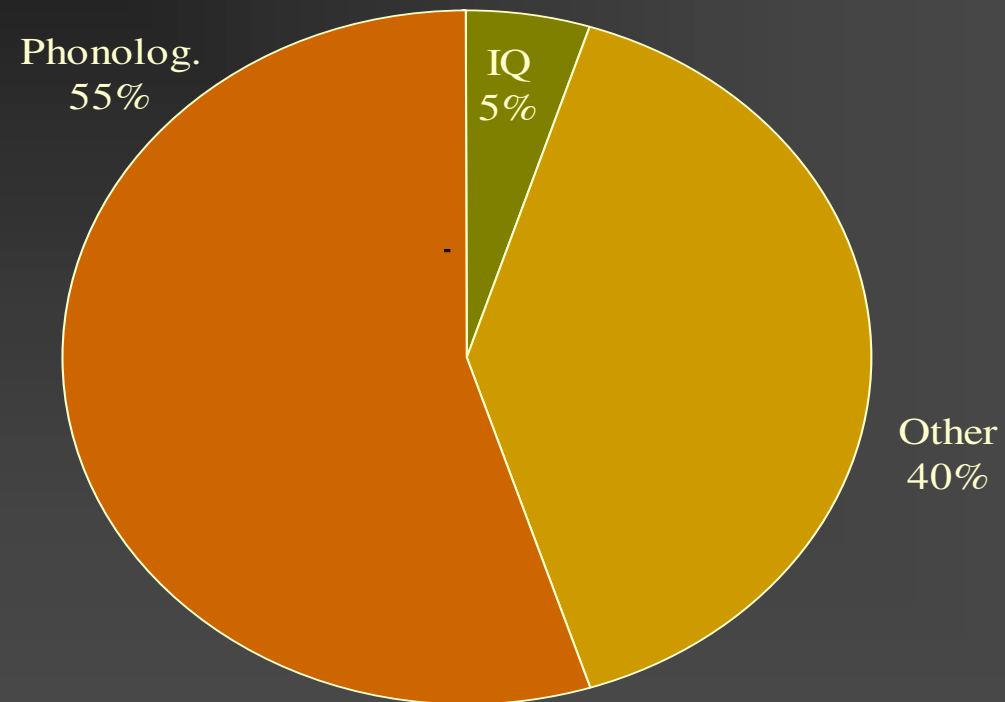
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graph TD; A[Poorly specified phonological codes] --> B[Poor phonological awareness]; A --> C[Slow naming speed & laboured retrieval of sounds]; A --> D[Verbal working memory deficits];
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Poor
phonological
awareness

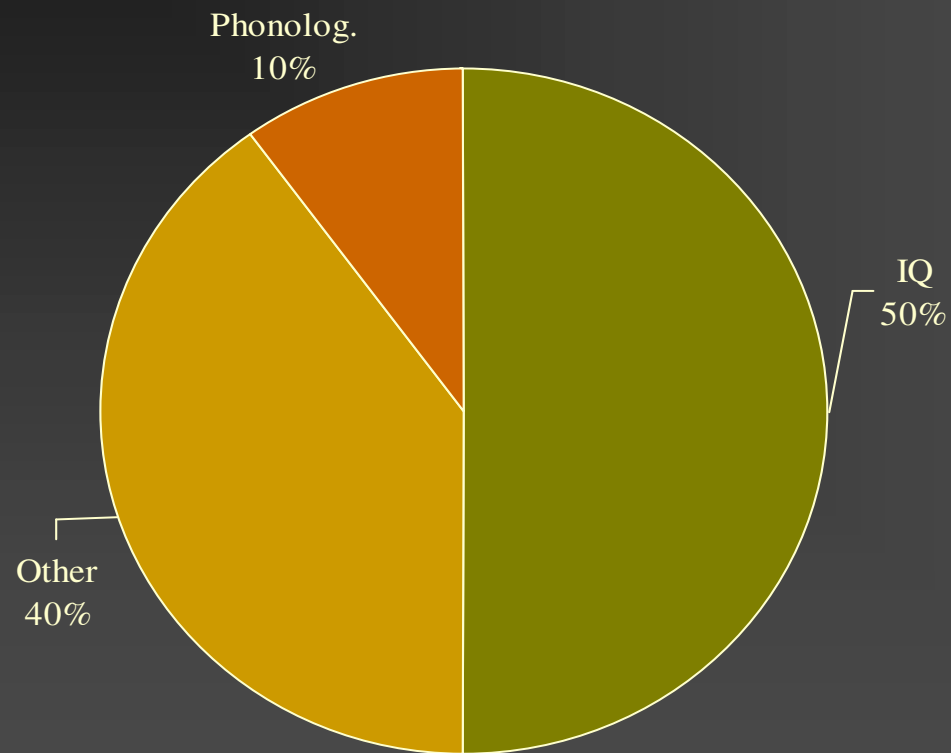
Slow naming
speed & laboured
retrieval of sounds

Verbal working
memory
deficits

Factors contributing to early literacy competence



Factors contributing to later literacy competence



Phonological Awareness

- Capacity to reflect on and manipulate (segment & blend) sounds within words
- Develops in stages reflecting the segmental character of the sound representations
- The most prominent and enduring weakness in people with reading and spelling problems
- The instructional component most likely to prevent reading failure

Phonological Awareness

- The best predictor of learning to read. Significant correlations ($r=.70$) between phoneme awareness and early literacy development.

Shankweiler et al (1999): PA in K predicted reading outcomes in Y9;

Scarborough (1991): PA in new school starters predicted reading level in Y1;

Juel (1991): Low PA in K predicted low reading in Y4

Phoneme sensitivity:

- enables child to crack the alphabetic code, to appreciate that spoken language maps onto print at the phoneme level.
 - enables development of efficient decoding skills
 - development of word specific orthographic information
 - growth in text comprehension. For 90% of cases, source of poor reading comprehension is poor word recognition skills.
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Naming Speed Deficits

- Ability to quickly access phonemes, phoneme strings whole words
- Strong predictive relationship between serial naming speed and early reading progress.

Torgesen et al (1999): Rapid naming speed in K predicted reading accuracy in Y2

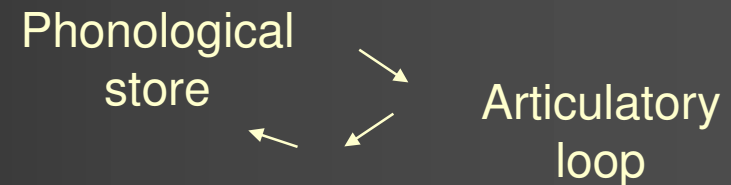
Berninger et al (1999): RAN score in Y1 predicted rate of growth of 'sight vocabulary' through to Y2

Naming Speed Deficits

- Effect: Constrains the development of orthographic images of words ('sight vocabulary'). Phonological codes activated too slowly to permit efficient encoding of letter combinations found in words.
 - Effect: Constrains text reading fluency due to slower individual word recognition.
 - Effect: Slower text reading compromises text comprehension.
 - A phonological deficit?
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Verbal Working Memory

- Temporary, time limited storage of aural information.
- Heavy demands on VWM during literacy skills acquisition.
- Laboured access to speech codes + slower speech rate impedes retention of information in VWM → poor segmentation & blending skills.



Double Deficit Hypothesis

- Two separable deficits:



which, when co-occurring may account for the more severe and difficult to treat literacy problems.

- Source of naming speed deficits - magnocellular?
- cerebellar?

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Genetic Predisposition

Biological

Perisylvian region abnormalities
(Broca's & Wernicke's areas, inferior parietal lobule)

Cognitive

phonological deficit -
poorly specified phonological
representations

Behavioural

Poor phonological
awareness

Slow naming speed / word
retrieval difficulties

Poor verbal working
memory

Poor reading and spelling

**E
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Language system
abnormality

Magnocellular/ cerebellar
abnormality

Biological

Cognitive

Phonological deficit

Motor control
/timing speed
deficit

Poor phonological
awareness

Slow naming speed

Poor verbal working
memory

Poor time
estimation

Deficits in
development of
automaticity

Poor reading and spelling

Behavioural

Are Reading Difficulties Hereditary?

Family studies:

1st degree relatives – 35-50% also have RD

Risk for child higher if affected parent still has RD vs
“compensated” RD

Risk estimates:

Boys with an affected parent = 40% (x7 risk)

Girls with an affected parent = 18% (x12 risk)

Both parents affected = 60-80%

What's inherited?

Phonological deficits ie. affected relatives show a
similar pattern of processing deficits.

Early Identification

- Early ID Measures
 - articulation accuracy
 - phoneme identification & deletion
 - naming speed tasks
 - repetition of non-words & multisyllabic words
 - letter sound knowledge
- Prediction hit rates = approx. 85% of children correctly identified in K or Year 1.

At risk markers:

- Family history of reading difficulties
 - Delayed speech and language development
 - Persistent difficulties with expressive phonology
 - Evident naming, word retrieval difficulties
 - Difficulty learning the alphabet
 - Poor spontaneous spelling
 - Difficulty with other rote sequences (eg. days of week, birthday)
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Implications from the research

- Identify and commence remediation early.
“Orthographic avalanche” from Y3 (400 words) → Y4 (4,000 words) → Y6 (10,000 words). 74% students who are poor readers in Y3 remain poor readers in Y9.
- Instructional emphasis on teaching phonemic awareness; explicit instruction in segmenting and blending strategies matched with letter forms.
- Focus on accurate and rapid access to individual letter sounds, sound combinations and whole words.
- Inbuilt, extensive revision.
- Resistance of improvements to fluency in older LD students.

Prevention vs Remediation

	Remediation		Prevention	
	Y3 –Y6 (67.5 hours)		Year 1 (88 hours)	
	Pre	2yr FU	Y2	Y4
Text Rate	71.3	71.7	93.3	96.8
Text Accuracy	75.8	91.0	96.7	98.5
Word Attack	69.3	91.9	101.1	99.8
Word Ident.	67.6	85.5	100.7	95.6

(Torgesen et al, 1999)