

# Screening and intervention: a stitch in time saves nine!

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**Kuching Sarawak**

# As I see it: A poem by a 12 year old dyslexic boy

- *My prolem is like a wast paper bascit full of scrunched up peses of paper.*
- *Words are like lifes blowing in the wind*
- *Just when I think I have cort up with them they blow out of rech.*
- *A page is like a map I tri to find my way round*
- *Maybe onebay the greadrefens will maykesens.*

I see creativity and frustration!

# Plan of Talk

- Evidence for early screening
- Towards screening tests
- The Dyslexia Screening Tests (3.5-75!)
- Linking Intervention to screening
- Conclusions – the way forward!

Acknowledgements: Rod Nicolson  
Psychological Corporation, Leverhulme Trust, Nuffield Foundation

# Definitions

- Reading performance that is markedly below what is expected, based on a person's intelligence.'

- “a disorder in children who, despite conventional classroom experience, fail to attain the language skills of reading, writing and spelling commensurate with their intellectual abilities”.

*World Federation of Neurology (1968)*

- an ‘enigma’

- a mess

- fail for two years before diagnosis possible...

- ‘You taught him to read Jean, so he can’t be dyslexic...’

- Symptom not cause

# Children with dyslexia.....

- are the largest group of children with special educational needs in mainstream schools.
- Have a disorder in one or more areas of learning, usually in learning to read.
- may have associated problems with writing, spelling, speech and language, maths, co-ordination, speed, essay writing, memory, lower self-esteem, and some will have attention deficit disorder (ADHD) and problems with social skills which reach far beyond reading!
- Their problems may be misunderstood - both parents and teachers may think they just not trying!

# Problems in young children with dyslexia

- **Many have good language but subtle Verbal and language problems**
- Muddled and jumbled words and letters, e.g. 'cobbler's tub' (toddler's club; par cark for car park)
- Word finding, labelling and/or categorisation difficulties
- Using the correct words, e.g. mislabelling and substituting words - mixing up elbow and shoulder and calling them soldier and oboe
- Speed in Processing and responding to spoken or written language
- Following instructions

# Language and listening skills

- Some may have poor language
- problems with Speech development – understanding words which they hear, or producing words
- **Many will have problems Listening**
- Discriminating between similar words and letters, e.g. dog/god, van/fan, v/f/th
- Identifying rhyme and rhythm
- *This may be helped by speech therapy*

# Visual processing problems

- **Some (but not all) will have Visual processing problems which affect reading**
- Problems with left to right eye movements
- Difficulty keeping place on page
- Letters jumble and blur on page
- Associated tiredness and headaches
- Matching letters
- *This may be helped with coloured lens or overlays*

# Memory and sequencing Problems

- **Most will have problems with short term or working memory and Sequencing**
- Remembering information they see or hear
- Recalling a sequenced activity (months, tables)
- Remembering Instructions, remembering action songs, nursery rhymes
- Numbers including tables later on
- Threading and matching coloured beads to a pattern
- Dressing

# Motor skill Problems

- **Many will have problems in Motor Skills**
- Throwing, kicking or catching a ball
- Hopping and/or skipping
- Excessive tripping, bumping into things and falling over
- Getting dressed efficiently and putting shoes on the correct feet
- Mixing up right and left, and scoring own goals!
- Threading and other fine motor skills

# Impact on learning

## Language problems and literacy

These lead to problems in early learning including:

- Naming letters and numbers
- Identifying letters (graphemes) and linking these to sounds (phonemes)
- Breaking words up into sounds for reading
- Identifying the correct sounds for spelling
- Problems with Word and Alphabet knowledge
- Speed of language production – shown in tasks such as rapid naming

# How does this affect school?

- **Most will have problems in writing**
- Forming letters
- Too much crossing out or rubbing out
- Poorly formed and messy handwriting
- **Some will have problems with attention**
- Sustained concentration
- Attention and perseverance on tasks
- This may be because they find it difficult, or because they have a specific problem with attention
- Dyslexic children may become anxious or disruptive, and their failure impacts on their self-esteem
- Problems affect all areas of the curriculum

# A typical child with dyslexia...

- Problems in reading, writing and spelling
- Slow to complete work
- Seems to make careless mistakes
- Seems to know something one day, then forgets it!
- Seems not to listen
- May be disorganised and untidy
- Slow to change for gym
- May daydream, or clown around!
- Most children have problems in more than one area

# Strengths in dyslexia

- Difficulties may be surprising! These can be children with encyclopedic knowledge about areas of interest!
- Often have strong verbal skills
- Creative and artistic
- Good with pattern matching and non-verbal reasoning
- Able to see the ‘bigger picture’
- May give the right answer, but not know how they got there!

# Main theories of dyslexia

1. Phonological Deficit Theory (1980s)  
Bryant, Snowling, Stanovich
2. Automatisation Deficit Theory (1990)  
Nicolson & Fawcett
3. Double Deficit Theory (1990s)  
Wolf & Bowers
4. Sensory (magnocellular) deficit Theory (1990s)  
Tallal, Stein
5. Cerebellar Deficit Theory (1995, 2001)  
Nicolson & Fawcett
6. Procedural Learning Deficit (2007)  
Nicolson & Fawcett

# 1. The Phonological Deficit Hypothesis

- The reading difficulties are caused by problems in phonological processing, that is breaking a word down into its sounds. These difficulties cause problems in sound segmentation and also in word blending, both of which are critical for development of reading and spelling.
- Bradley and Bryant (1983) rhyming
- Stanovich (1988). ‘Phonological core,’ model
  - one key to fluent reading is the development of automatic single word reading – problems relate to phonology

## 2. The Double Deficit Hypothesis (eg. Wolf & Bowers, 1997)

- Wolf and Bowers argue that dyslexic children suffer from two crucial deficits:
- (i) Phonological processing problems
- (ii) Rapid processing problems
- Problems in both these mean child has particularly severe difficulties
  - 1 speed (measured by rapid naming)
  - 1 phonology (measured by segmenting words into their constituent parts)

# 3. Magnocellular Deficit Hypotheses

(i) Visual deficits (Stein)

(ii) Auditory deficits (Tallal)

- These are based on slow processing of incoming information through the eyes and ears
- Evidence of less cells in the magnocellular areas of the brain
- Visual overlays, coloured lens
- Auditory FastForWord

# 4. The Automatisation Deficit Hypothesis

- Nicolson and Fawcett (1990) have shown that ‘automatisation deficit’ can explain the range of problems shown by dyslexic children.

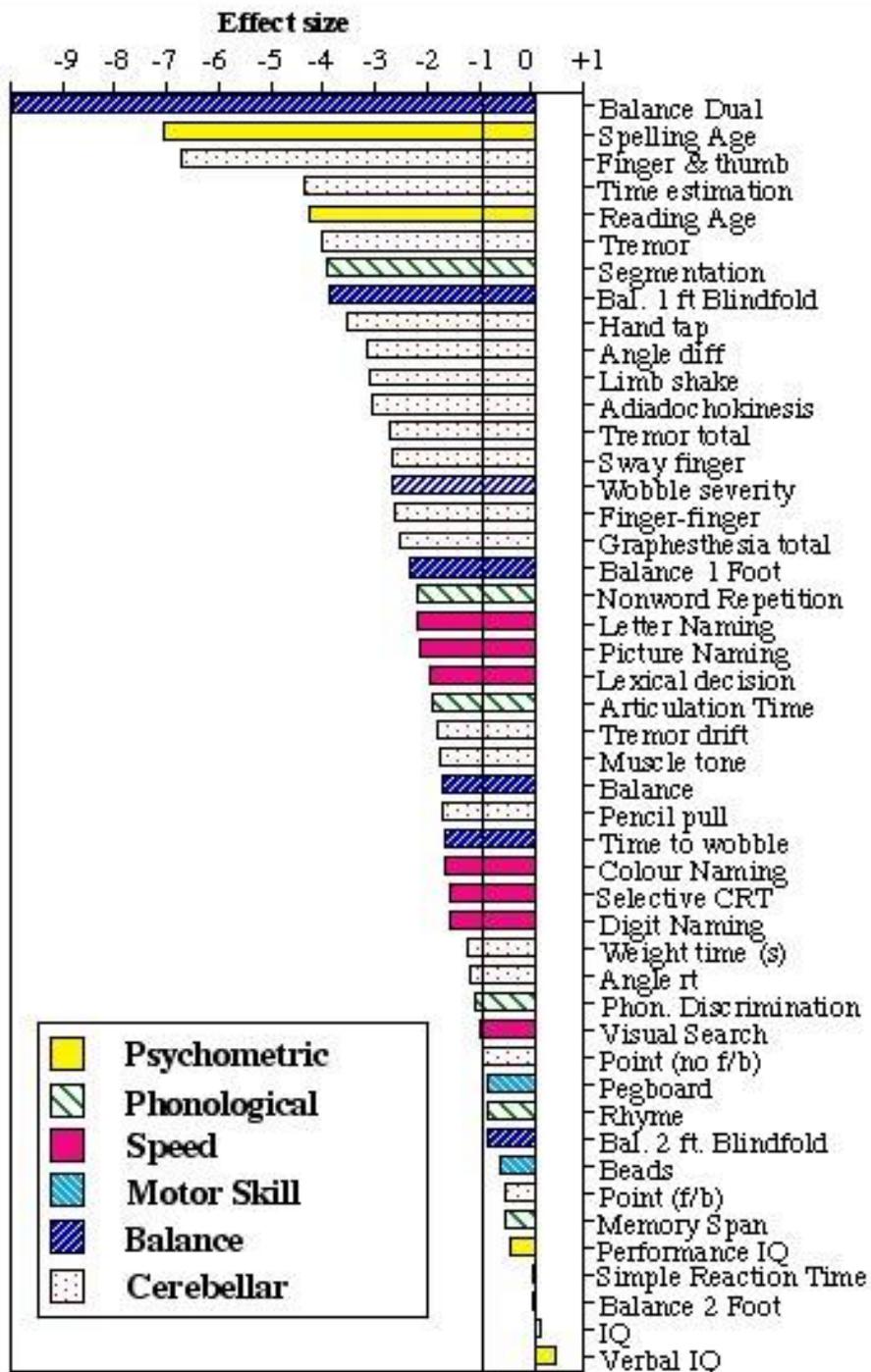
Automaticity is the final stage in learning when you become expert

Dyslexic children will have difficulties on any task that requires automatisisation of skill. This will show up most clearly on tasks which rely on fast and accurate performance. Even on a task where they appear to be performing normally they have to try harder to achieve the same results.

# 5. The Cerebellar Deficit Hypothesis

- Early research (Denckla and Rudel) suggested that dyslexic children showed a range of ‘soft neurological signs’. These are consistent with cerebellar abnormality
- Recent research by Nicolson, Fawcett and Dean on cerebellar function in dyslexia suggested that the cerebellum may be an underlying causal factor.

# Findings from our research



Difficulties in 8-17 yr old dyslexics are not limited to reading and phonology.

Clear deficits in speed and motor skill.

Unexpected problems can be linked to a part of the brain known as the cerebellum which is involved in learning.

Suggests all theories contribute to problems of dyslexia

# Key Questions for Dyslexia Research

- Q1. Can we identify dyslexia and other learning disabilities before a child fails to learn to read?
- Q2. Can we help these children to catch up with their peers and make this cost-effective?
- Q3. Can we identify those children who will be difficult to accelerate?
- Q4. Do we need different methods to teach dyslexic children? If so, what?
- Q5. What should we do next?

# Why screen for dyslexia?

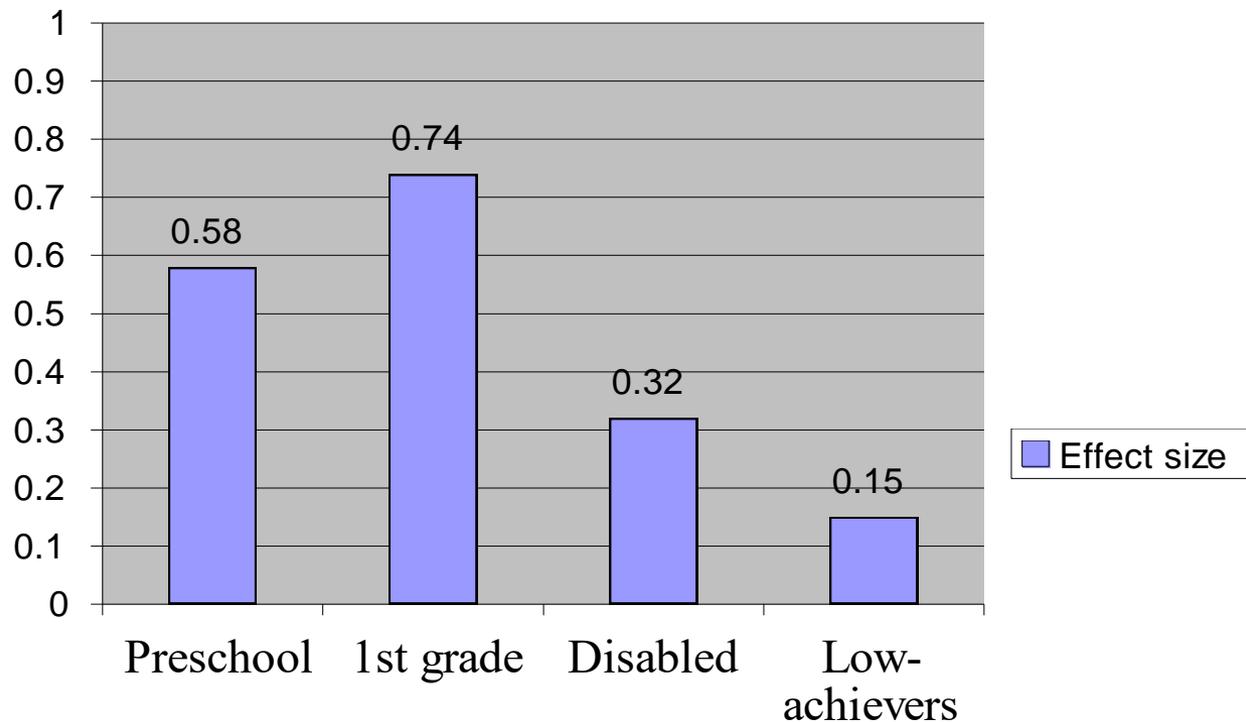
- Commonest developmental disorder (around 5%)
- Genetic origin, 50% chance of child suffering if their parent is dyslexic, persists into adult life
- Appropriate teaching support improves reading, phonological skills, spelling and confidence (Rack, 1994)
- Lack of support leads to continuing failure, problems become entrenched and generalised
- The earlier support can be provided, the more cost-effective it will be. The stitch in time approach
- This is particularly important for Asian countries, such as Sarawak where children do not start school until they are 7, the quality of pre-school provision varies, and children who are not successful may drop out of secondary school.
- *Our aim - to identify problems before children fail!*

# US interventions (Torgesen, 2001)

- 10 year programmes funded by Govt / NICHD (~\$1billion)
- i) 'Pure' phonological interventions (Method A vs B) do not generalise to reading - disappointing!  
Change in emphasis to add fluency (cf. Wolf)
- ii) 'Closing the gap' at secondary level. Special ed improves reading only 0.04 st. dev (class sizes!)
- iii) 'Junior' level (8-11)  
Need individual intensive intervention, 67.5 hrs  
Gains per hour of instruction 0.2 ss
- iv) Prevention more effective and cost effective than remediation!

# Phonics intervention is most effective for reading in 1<sup>st</sup> grade

Effect of intervention for at risk and learning disabled



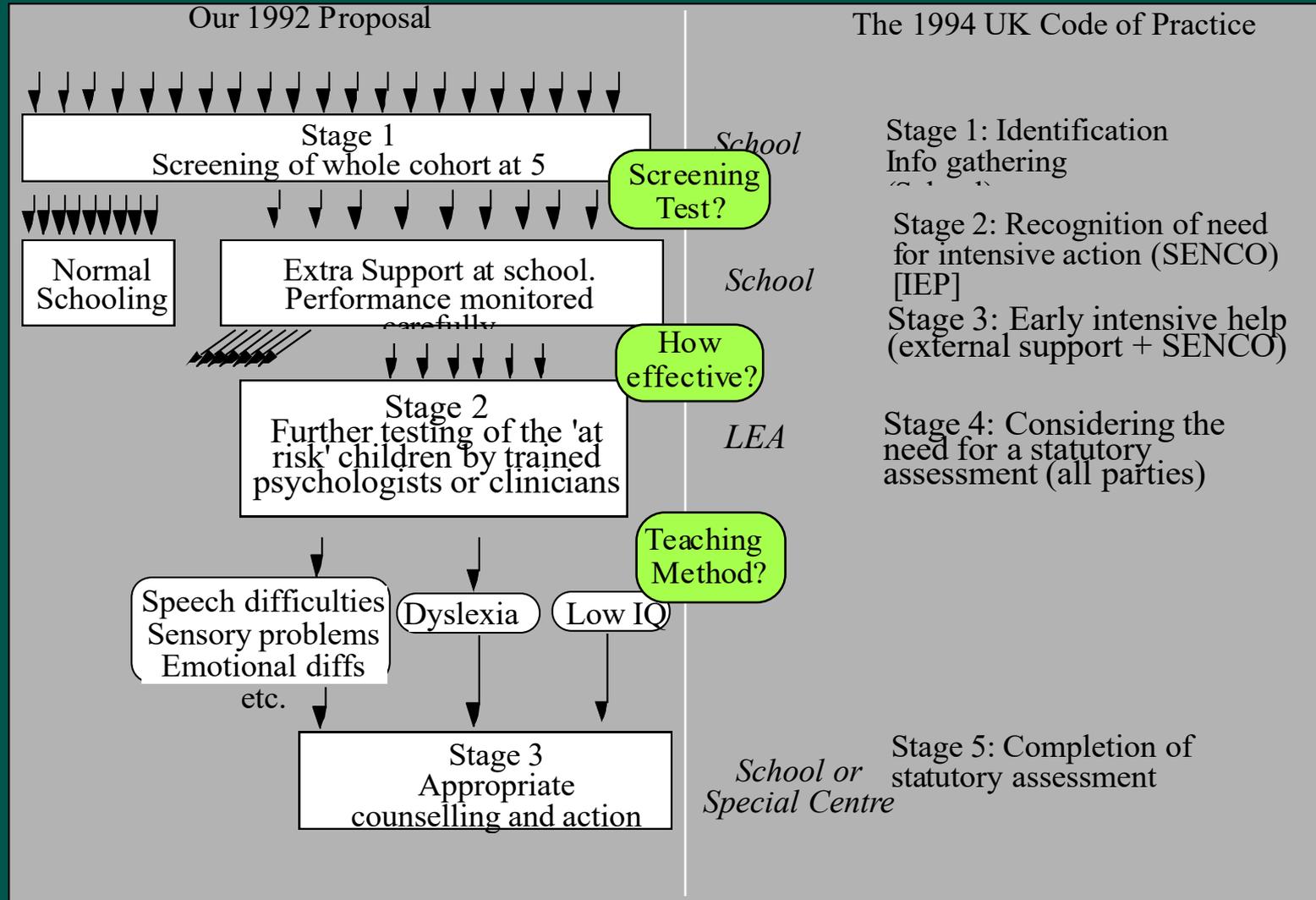
Data from the National Reading Panel  
(0.2, 0.5, 0.8 small, mod and large ES)

# Towards Screening Tests for Dyslexia

- **Requirements**
- Theoretically Defensible
- Valid, objective, reliable, normed
- Practically Useable
- quick, simple, intelligible
- Politically acceptable
  - Parents, Children, Schools, Teachers, Local Authorities, Educational Psychologists, Government
- the tensions between these various requirements mean that any screening test is a compromise between thoroughness and cost!

# Screening, Support, Policy

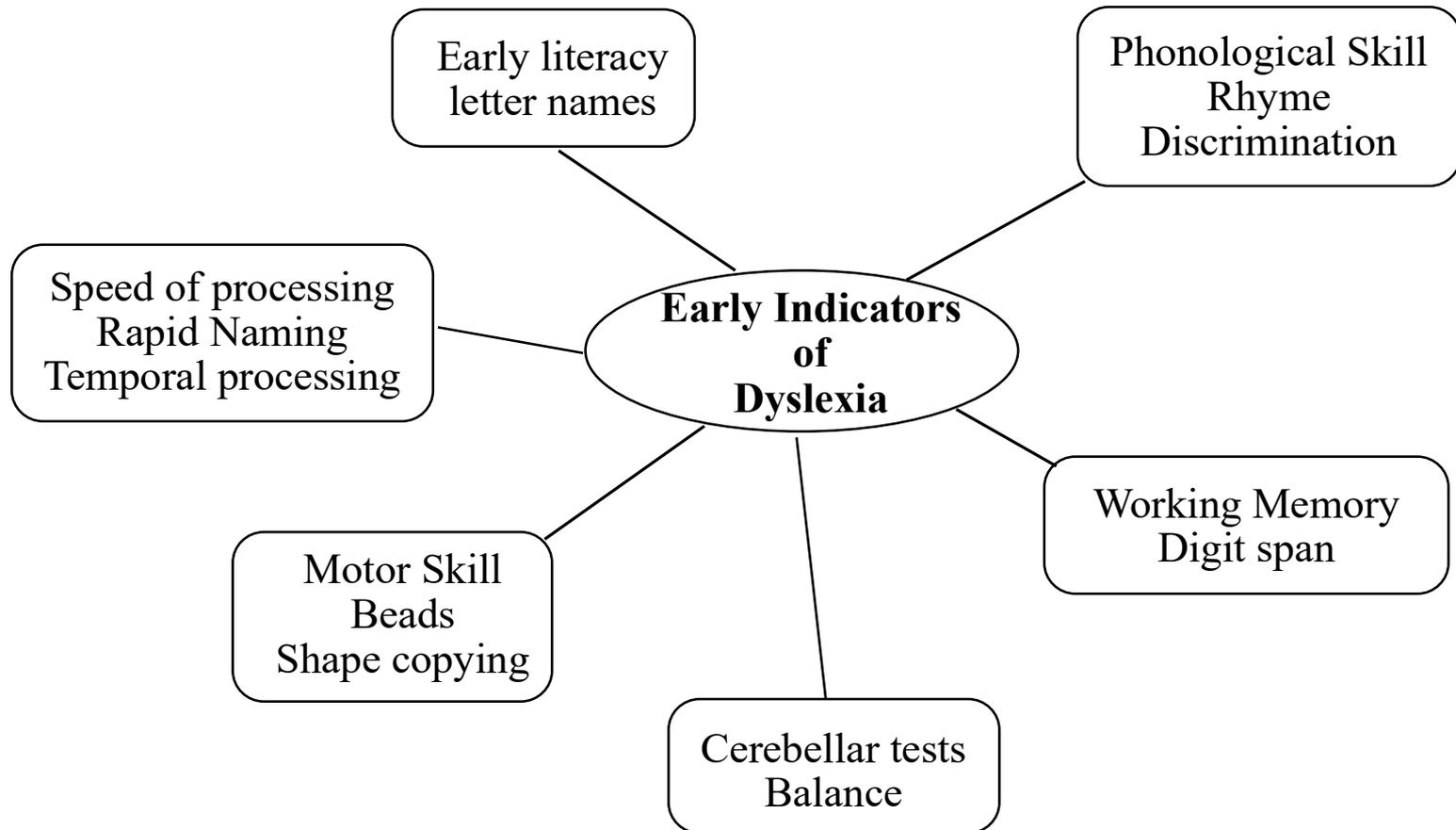
## The blue-print



# Approach adopted in developing tests

- Develop a 10 sub-test, 30 minute diagnostic battery of theoretically motivated tests covering a wide *range* of skills, cognitive, literacy, phonological, speed, knowledge and motor
- Must be quick and easy to administer, in pencil and paper format
- Gather performance data from over 1000 ‘normal’ children for the DEST
- Analyse the norm data and adjust the instructions and content, based on feedback from users
- Construct norms for the DEST (4:6 to 6:5 yrs)
- Publish with the Psychological Corporation 1996 - now best sellers and 2nd editions published!

# The Dyslexia Early Screening Test



The DST and DAST measure fluency, including 1 minute reading and copying, nonsense passage, spelling, verbal and semantic fluency.

# Components of DEST and DST tests

## **DEST (4:6-6:5) Pre-reading**

*Cognitive/phonological/speed*

- Test 1 Rapid Naming
- Test 3 Phon' Discrim
- Test 5 Rhyme detection
- Test 6 Digit Span
- Test 7 Digits
- Test 8 Letters
- Test 9 Sound order

*Motor*

- Test 2 Beads
- Test 4 Postural Stability
- Test 10 Shape Copying

## **DST (6:6-16:5) Literacy**

*Cognitive/phonological/speed*

- Test 1 Rapid Naming
- Test 3 One minute reading
- Test 5 Phon' Segmentation
- Test 6 Two minute spelling
- Test 7 Backwards Digit Span
- Test 8 Nonsense passage read
- Test 9 One minute writing

Test 10 Verbal fluency (S)

Test 11 Semantic fluency

*Motor*

- Test 2 Beads
- Test 4 Postural Stability

# Phonological skill:DEST and DST

- A series of phonological tests designed to tap more complex skills as the child develops into an adult
- I )a) Rhyme and b) Discrimination DEST
  - A) Can the child say whether or not two words rhyme?
  - leg hen pin win cup pup hop doll toe toad
  - B) Can the child say whether or not two words are the same ?
  - bad, dad cap, cap. Turn away so child can't lip read
- 2) Segmentation DST
  - Say *stake* Say it again, but without the /st/
  - Say *stake* Say it again, but this time without the /s/

# DEST and DST: Rapid Automatised Naming



# DEST Test 9: Sound order

- Child listens to pairs of sounds (a squeak [mouse] and a quack [duck]) on tape, and has to say which one was first, the mouse or the duck. The separation between the sounds is steadily decreased, making the task harder and harder.
- This is based on work by Paula Tallal which indicates that language-disordered children often have difficulties with this type of rapid temporal processing task.

# DEST: Knowledge and working memory

## DEST Test 7: Digit Naming

- The child has to say the names of the following digits. A straightforward test of knowledge.
- 4, 8, 3, 9, 5, 7, 6

## DEST Test 8: Letter Naming

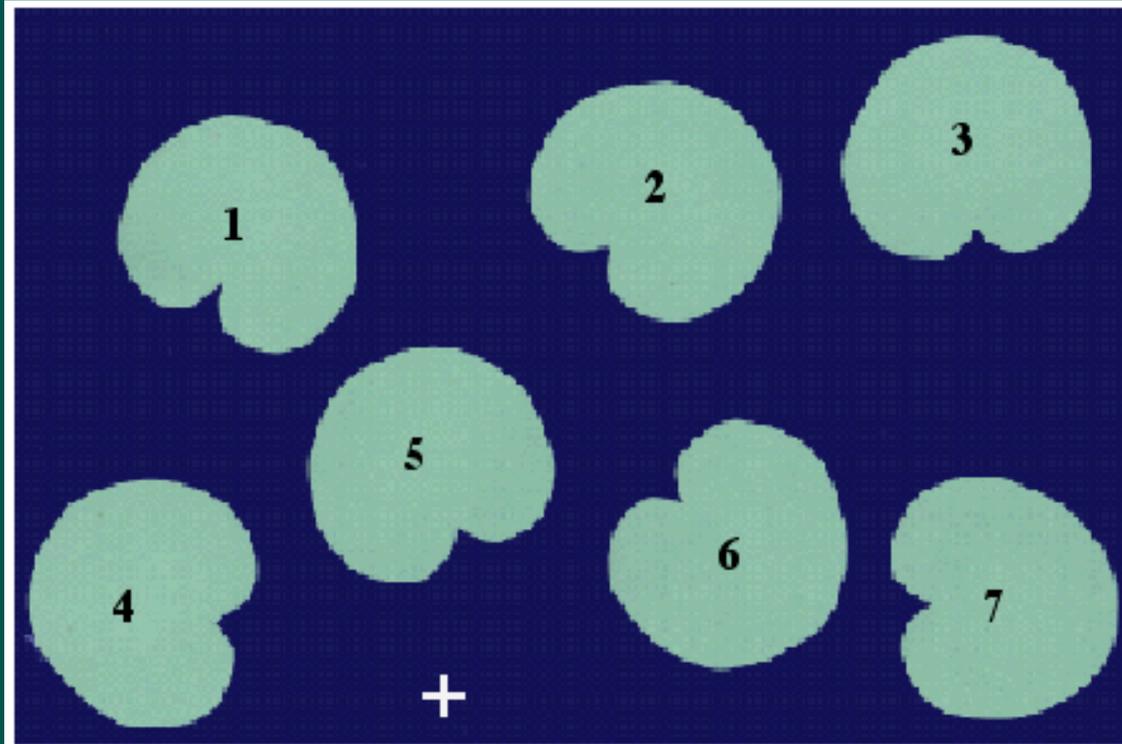
- The child has to say the names of the following letters
- t, s, d, e, w, o, b, q, n, y

- **DEST Test 6: Digit span.**

- **DST Test 7: Backwards Digit span**

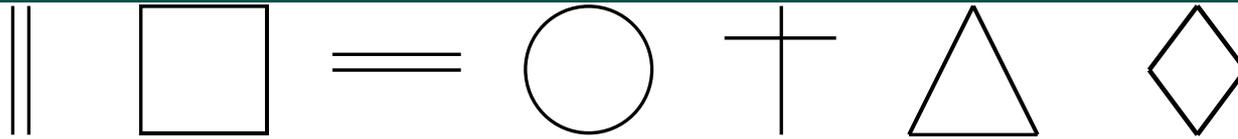
- Standard tests of memory for a series of numbers

# Visual Memory: Corsi frogs



- A spatial memory game, jumping a frog on to the lily pads.
- AJF's fun version of Corsi's traditional memory test which uses boxes.

# DEST Test 10: Shape Copying



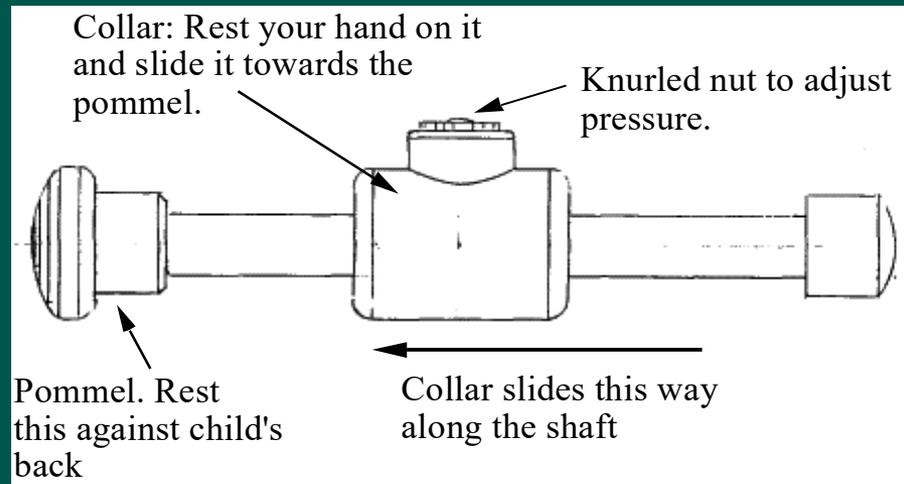
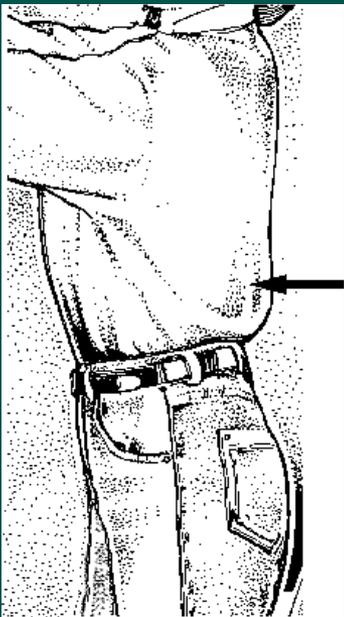
## Scoring examples

score= 3	score= 2	score= 1	score= 0
Near perfect. Correct number of sides in correct configuration, joined smoothly.	Good. Correct number of sides, configuration good, maybe some slight overlaps at join, maybe slightly wobbly	Pass. Correct number of sides, but problems with joins, wobbles, orientation etc.	Fail. Wrong number of sides or configuration seriously wrong. Barely recognisable.

DEST and DST Bead threading. How many beads can you thread in 30 seconds?

# DEST and DST: Postural Stability

- **Balance Tester**
- *Not to scale!*



- How much the child wobbles when pushed gently in the back.
- Standard test of cerebellar function (balance) score 0-6

# Vocabulary DEST and DST

- This test was developed for DEST-2 to provide a simple measure of receptive vocabulary and reasoning ability, and can be administered individually or in a group. The vocabulary test is in a multi choice format, similar to the British Picture Vocabulary Scale (BPVS, Dunn et al, 1982). It was designed to augment the DEST with a rough measure of verbal ability, to inform the development of the IEP.
- Note that some of the questions tap IQ – no-one is expected to know what a ‘habit’ is, but it can be worked out from knowing the other pictures.

# Fluency in reading (DST)

- DST 1 minute reading (sample)
- Read down as fast as you can! Say 'pass' if you don't know the word
- pat
- fog
- king
- oil
- golf
- tea
- fun
- gear

- Nonsense word passage sample
- *Age 6:6- 8:5*
- One day a mib fell into the feg. He was so sup and tid that he cried.
- *Age 12:6-16:5*
- In the olden days, a rennifer set out to craiberg an enormous dollitroy that threatened his country .
- Time and accuracy scored. Time bonus & penalties. Score 2 for nonsense words

# DST 2 Minute Spelling

How many words the child can spell correctly in 2 minutes, with the tester dictating the next word as soon as the child finishes the previous one.

Start here for 6.5 - 9

*bus*

*cat*

*day*

*five*

Start here for 9.5+

*morning*

*school*

*tonight*

*tomorrow*

*tongue*

*laugh*

*Wednesday*

*foreign*

Extras for adults

*separate*

*receipt*

# DST: Fluency in writing

- This is designed to assess speed of writing. Dyslexic children are slower (and less neat) writers. Writing speed is currently one of the key issues for examination allowances. Score is primarily the number of words transcribed in one minute, with adjustments made for errors.
- I am copying a short passage to check my speed of writing. I have one minute to finish as much as I can. I should work quickly but accurately, so that my handwriting can be read.

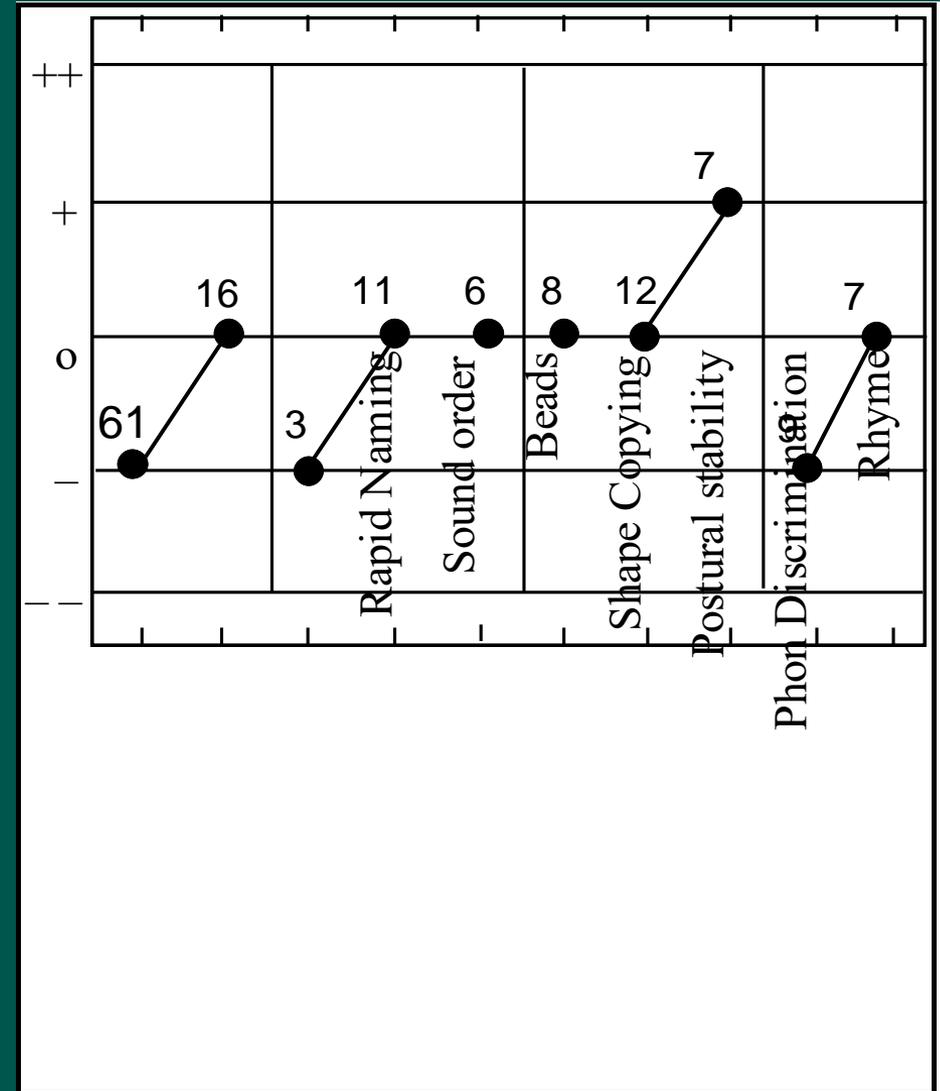
# Scoring the DEST

	Test score	At risk index	--	-	0	+	++
1. Rapid Naming	66	0	90 or more	72-89	50-71	40-49	39 or less
2. Beads	3	--	0-2	3	4	5	6 or more
3. Postural stability	20	--	12-24	8-11	2-7	1	0
4. Discrimination	0	-	0-5	6	7-8	(8)	9
5. Rhyme	5	-	0-3	4-5	6-11	12-13	(13)
6. Digit span	3	-	0-2	3	4-6	7	8 or more
7. Digit naming	5	0	0-4	5-6	7	(7)	(7)
8. Letter naming	9	--	0-1	2-5	6-10	(10)	(10)
9. Sound order	8	-	0-8	9-11	12-15	16	(16)
10. Shape Copying	5	-	0-3	4-5	6-9	10-11	12-21

Each test score is converted into an age-appropriate normed score, using the norms we have gathered in our national testing programme. There are separate norms for 4:6 - 4:11, 5:0 - 5:5, 5:6 - 5:11, 6:0 - 6:5

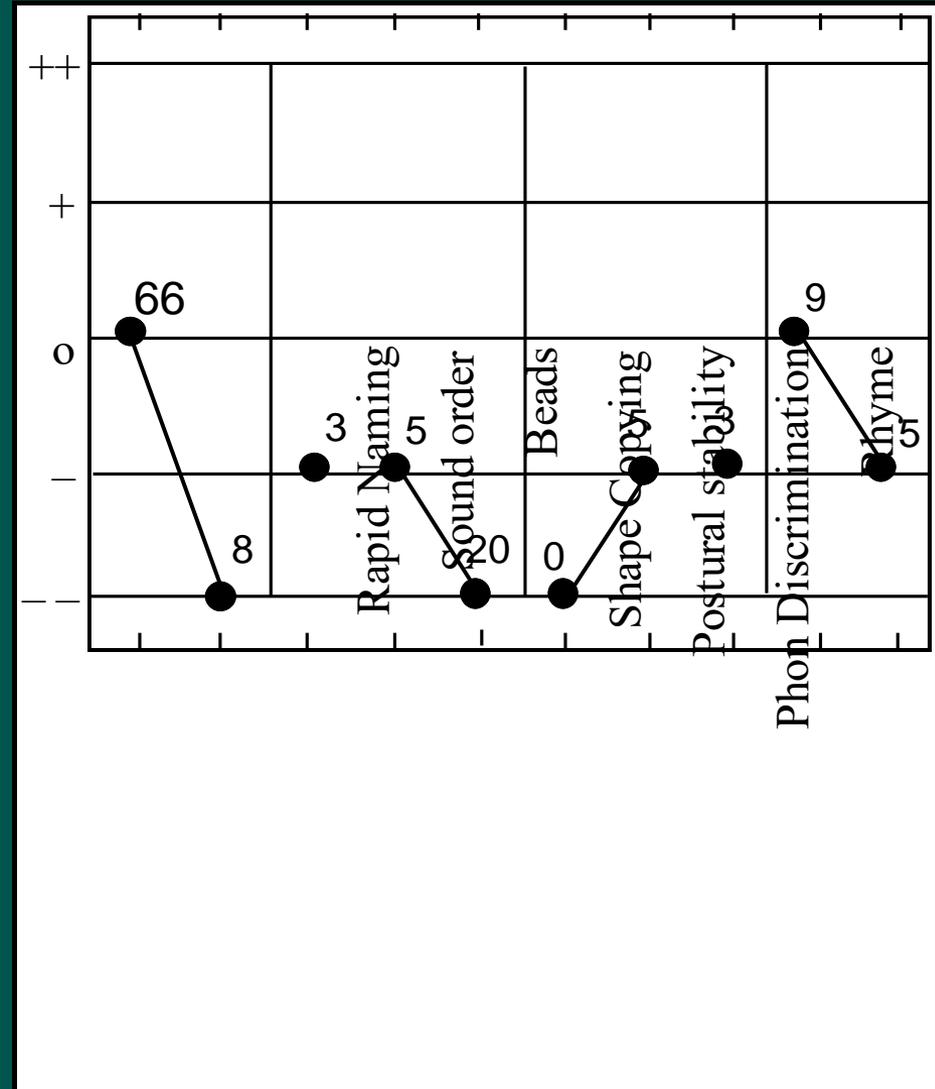
# Working out the 'at risk' score and profile

- Fill in the raw score for each test on the score sheet. Compare scores with norms for profile.
- 0 is average, - below, + above.) DEST has 2+ to pick out high achievers
- The profile shows which areas to address for the IEP
- Work out the 'at risk' score by scoring 1 mark for each - score, (0 for the rest) and dividing by 10.
- An ARQ of 0.9 is strong risk, and 0.6 mild risk



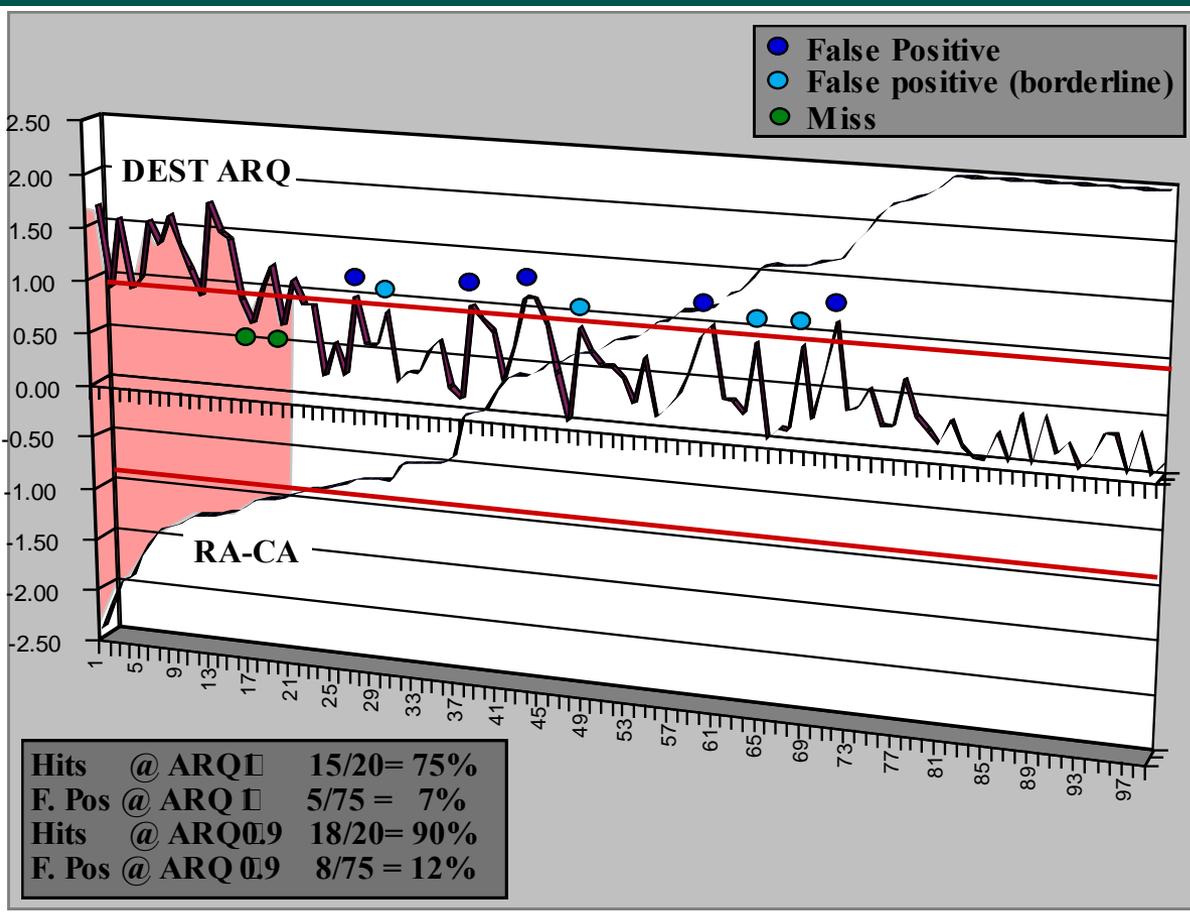
# Case study: the DEST

- age: 5:5
- language delay, lethargic, head injury
- *Outcome*
- -- 3, - 5, total (2 x 3) + 5 = 11
- At Risk Quotient 1.1



# DEST Validation Study (100 children)

- Tested on DEST at 5
- Re-tested on reading and spelling at 7
- Hit rate = 90%, False positive Rate = 12%
- Criteria 0.9 DEST, 10 month reading deficit
- DST and DAST hit rate 94% dyslexics, 0% controls



# Support - General approach adopted

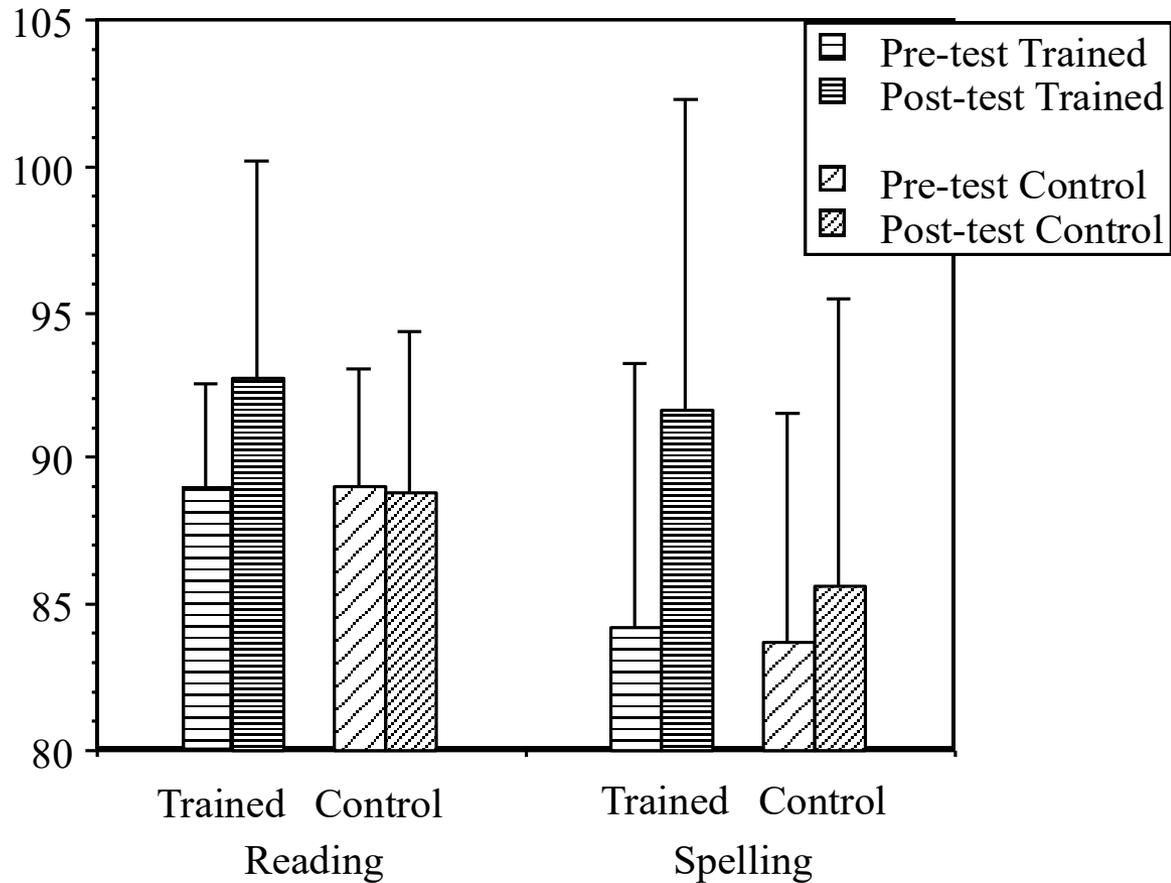
- Screen for potential problems, using teacher recommendations and/or screening tests
- Develop an Individual Education Plan for each child on the basis of profile of strengths, weaknesses, attainments and objectives
- Create groups of 2-3 children with similar IEP's
- Give structured group support in 2 half hours per week
- Evaluate progress at the end of 10 weeks support

# Study 1 Screening and Support (Infant)

**Nicolson, Fawcett, Nicolson, Moss and Reason, 1997**

- Schools in deprived / non-deprived areas in 2 cities
  - 16 children identified 'at risk' in each school [64 children, age 6.0 (5.5-7.0), RA 5.6 (5.3-6.0)], plus Controls
- **Pretest.**
  - WORD tests of reading and spelling, BPVS vocabulary, Dyslexia Early Screening Test (DEST)
- **Intervention**
  - Interactive Assessment & Teaching intervention in groups of four, for 20-30 minute sessions, three times a week for 10 weeks
- **Post-test.**
  - WORD reading and spelling

# Study 1 Results of intervention



Significant improvement for trained group, standard score for reading 'Accelerating' from 88.9 to 93.2. Controls deteriorated slightly

# Study 2. Effectiveness of Junior Intervention

## Fawcett, Nicolson, Moss, Nicolson and Reason (2000)

Schools selected in deprived / non-deprived area in 2 cities

16 children identified 'at risk' in each school

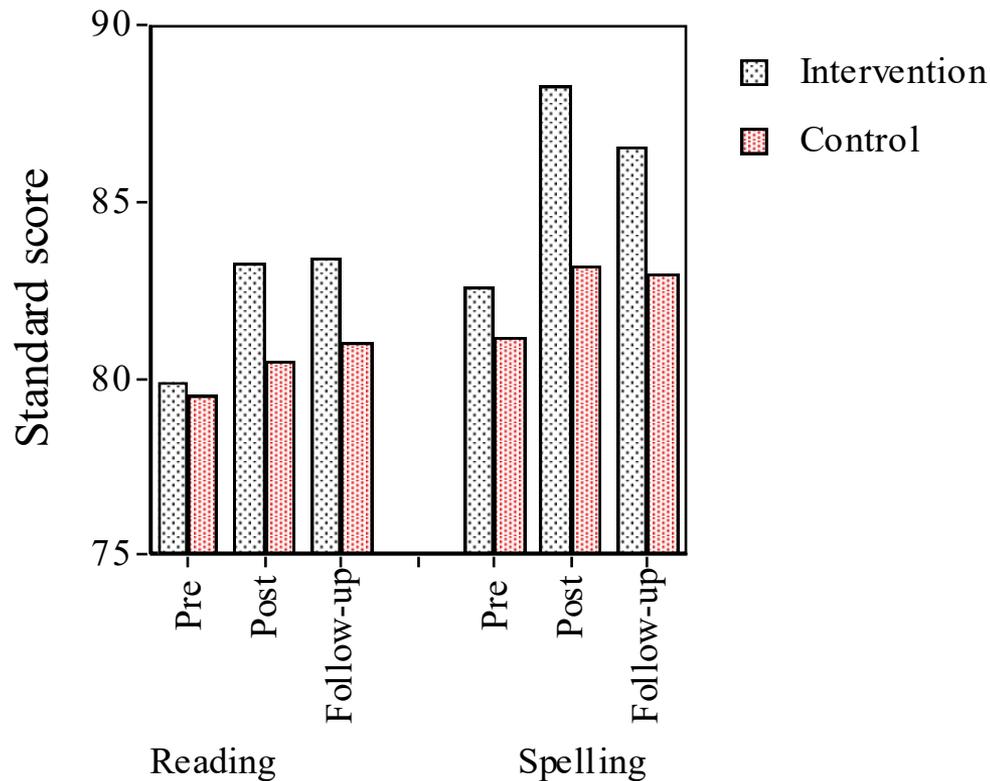
[36 children, age 7.6, reading Standard Score 79.9, spelling 82.6].

51 Control 'at risk' children

- **Pretest.** WORD reading, spelling, BPVS vocabulary, DST
- **Intervention** 'IA & T' intervention in groups of two, for 30 minute sessions, twice a week for 10 weeks
- **Post-tests** WORD reading and spelling (curriculum-based reading skills)
- **Follow-up (6 months later)** WORD reading and spelling

# Results of Junior school evaluation

Effects of intervention on reading and spelling



- Significant improvement in reading and spelling (3.4, 5.7 respectively) persisted 6 months later.
- Controls 1 and 2 point improvement (NB Literacy Hour!)

# Implications of poor performance on DEST

	Test	Suggests...	Implications	Actions
Test 1	Rapid Naming	Speed	diagnostic	
Test 2	Beads	Poor dexterity	diagnostic	
Test 3	Phonological Discrimination	Hearing / Speech	Language Impairment?	Check hearing & speech
Test 4	Postural Stability	Balance / Muscle tone	diagnostic	
Test 5	Rhyme detection	Knowledge / hearing	diagnostic + readiness	check hearing, support
Test 6	Digit Span	Memory / Attention	diagnostic	strategy?
Test 7	Digits	Knowledge	readiness	support
Test 8	Letters	Knowledge	readiness	support
Test 9	Sound order	Hearing / Speed	diagnostic	train
Test 10	Shape Copying	Dexterity, writing	readiness	support

# Objectives of the Welsh research

- All children in reception age 5 were screened on DEST and those with a mild risk score of 0.6 received support in groups of 4
- The intervention we devised covers early literacy, physical development and readiness to learn based on a whole child focus of learning through play. It was launched as 'Hands on Literacy'
- Progress was evaluated following the intervention compared with similar children in a control school who had not received the intervention (but who received support later).

# The results!

Improvement for intervention group in all subtests of the DEST

Risk level reduced by 0.4 for intervention group, and for controls by 0.2 (training led to double the improvement provided by maturation and normal teaching).

Significant effect (1 tailed)

71% controls remained at risk, vs only 25% intervention group

Key pre-reading skills were improved in the intervention group

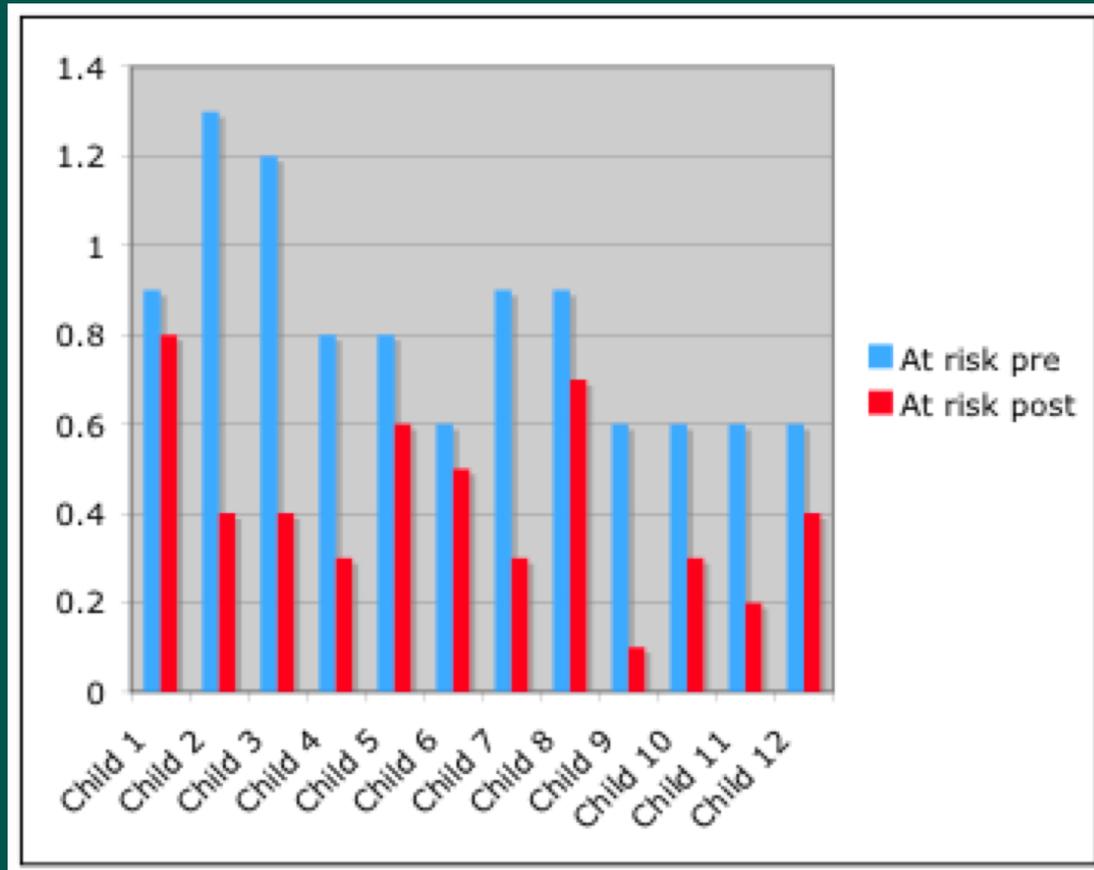
Significant improvement for 1st letter naming for intervention group (worse than controls at pre-test)

Significant improvement for letter naming

Research has shown these 2 skills are significant predictors of literacy

*Overall, endorsement for the intervention! 36 schools are now taking part, and children are tracked until they are 10 years old*

# Does it work for everyone?



Children with greatest difficulties (Child 2 and 3) made the most progress!  
Only 1 child made few gains (Child 1)

# Hands on Literacy

This pack is freely available for use with pre-school children. It has been colour coded to cover language, motor, visual and auditory

It includes a wide range of practical ideas for teachers to sample from, to provide support for a range of individual differences

It is designed to be charming, fun and approachable! Components include

- Phonological Awareness
- Auditory Memory
- Visual Memory
- Manual Dexterity
- Gross Motor
- Games are cumulative, but teachers can adapt them to suit their needs and they have found this one of the most enjoyable features

# Key Questions for Dyslexia Research

- Q1. Can we identify dyslexia and other learning disabilities before a child fails to learn to read? *Yes!*
- Q2. Can we help these children to catch up with their peers and make this cost-effective?  
*Yes!*
- Q3. Can we identify those children who will be difficult to accelerate? *Yes!*
- Q4. Do we need different methods to teach dyslexic children? If so, what? *I believe so*
- Q5. What should we do next? *More research*

# Conclusions on DEST, DST and intervention

Small group intervention can be effective and cost-effective

- 1) DEST valuable predictive index of children likely to need specialist support.
- 2) Early intervention in a child's first year at school (5/6 years), before literacy problems are compounded by the 'Matthew effect' is likely to be the most effective approach.
- 3) Junior school children (7+) with low 'at risk' scores on the Dyslexia Screening Test have a good chance of catching up with their peers following a relatively short intervention
- 4) However, those with high DEST and DST 'at risk' scores are likely to need continuing support over a relatively long period.

- *Implications for intervention – the earlier the better!*

# Conclusions – the way forward

- We have constructed 30 minute screening tests, based on existing theoretical findings
- These tests can identify problems before a child tries (and fails!) to learn to read.
- They lead naturally to early support, on the ‘stitch in time’ principle. Early results are very promising!
- They are suitable for use at pre-school or primary level
- These tests can identify both need and response to intervention, providing an effective and cost-effective solution

# Policy Implications

- The following three-stage intervention strategy is promising:
  - (i) children at risk of reading difficulties are identified between 5 and 8 years
  - (ii) at risk children are given a small-group intervention programme for 3-4 months
  - (iii) children still failing to make progress may then be given continuing targeted additional support.
- The results confirm the importance and cost-effectiveness of early intervention in a child's initial school years. While cost-effective improvements in reading can be achieved with older children, a significant proportion will fail to achieve lasting benefits from a relatively short intervention of this type, and there is therefore a need for continuing support.

*We have the tools to break into the cycle of failure.  
But there is much still to be done!*

# Further Information

- **Articles etc.**
- Fawcett, A.J. (ed. 2001). *Dyslexia: theory and good practice*. Whurr, London. Papers on theory and practice from the 5<sup>th</sup> International conference of the British Dyslexia Association, covering nursery, primary and secondary education.
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