

Developmental Disorders of Language, Learning and Cognition

Charles Hulme and Margaret J. Snowling

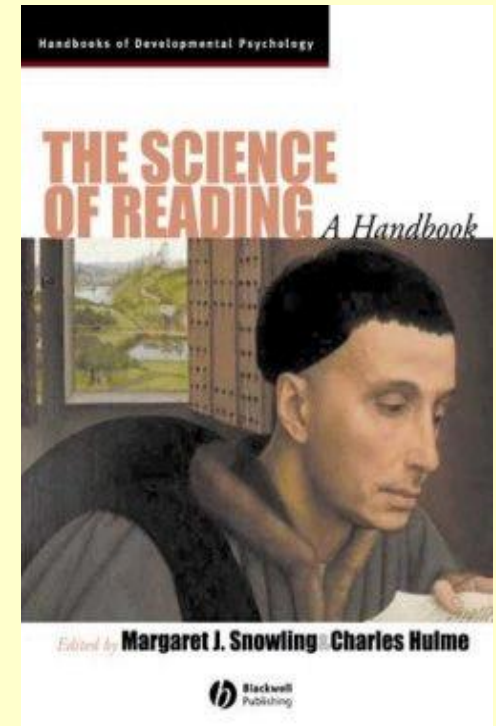


Interventions for Reading and Language Impairments

Charles Hulme

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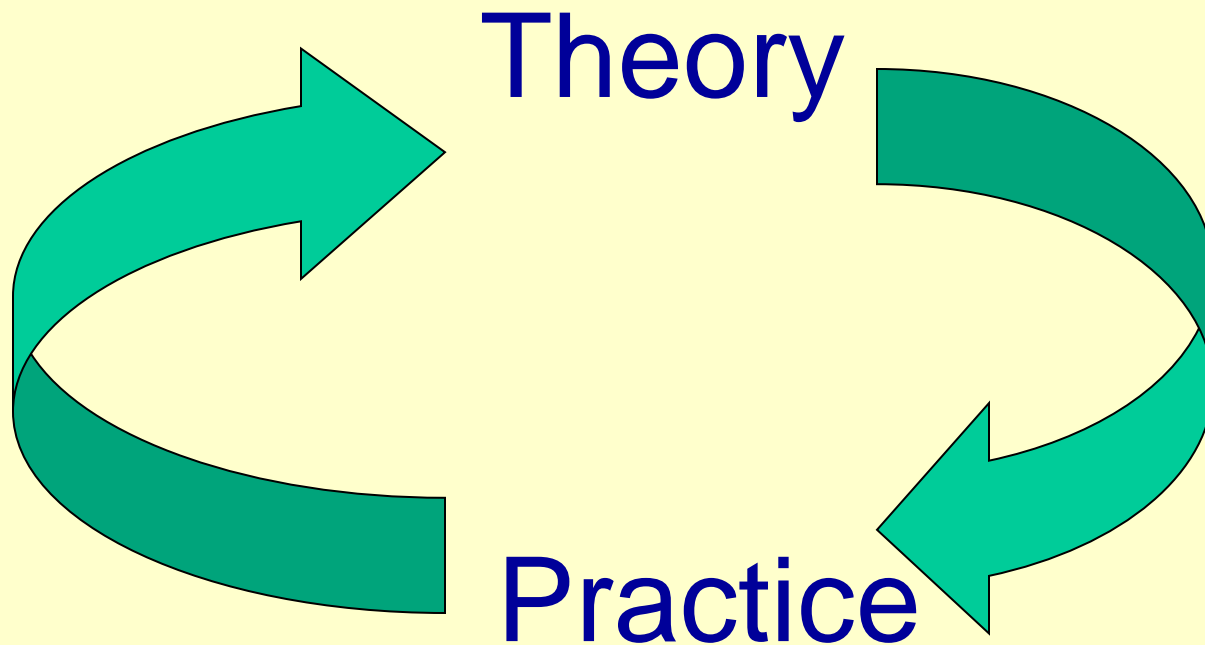
<http://www.york.ac.uk/res/crl/>



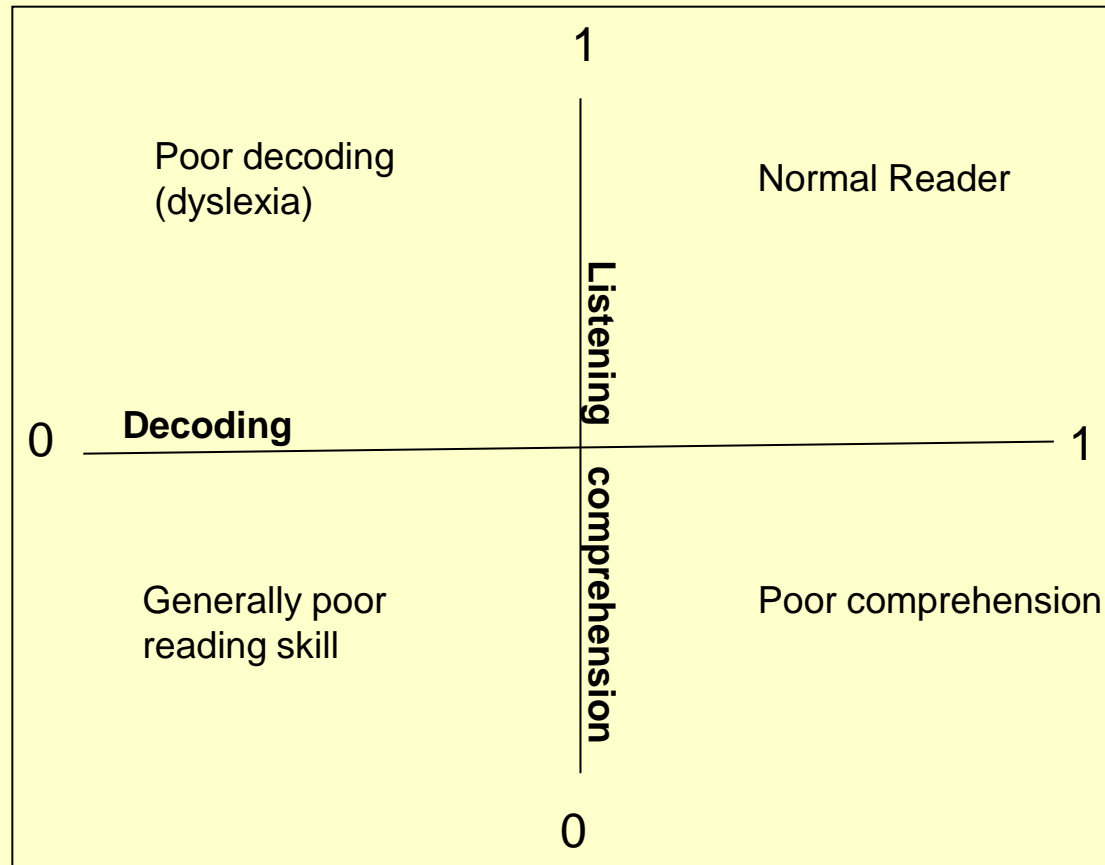
The Take Home Messages!

- Learning to read builds on a child's oral language skills which develop before school entry
- We need to distinguish between Decoding and Reading Comprehension
- Decoding depends critically upon phonology- particularly the development of Phoneme skills and Letter Knowledge
- Interventions that promote Letter Knowledge and Phonemic skills (in the context of reading instruction) are highly effective in developing decoding
- Interventions to boost Oral Language comprehension can be effective, and help to improve Reading Comprehension

The Theory and Practice of Reading Research/Intervention – a Virtuous Circle?



The Simple View of Reading (Gough & Tunmer, 1986)



$$R = D \times C$$

Reading and Phonology

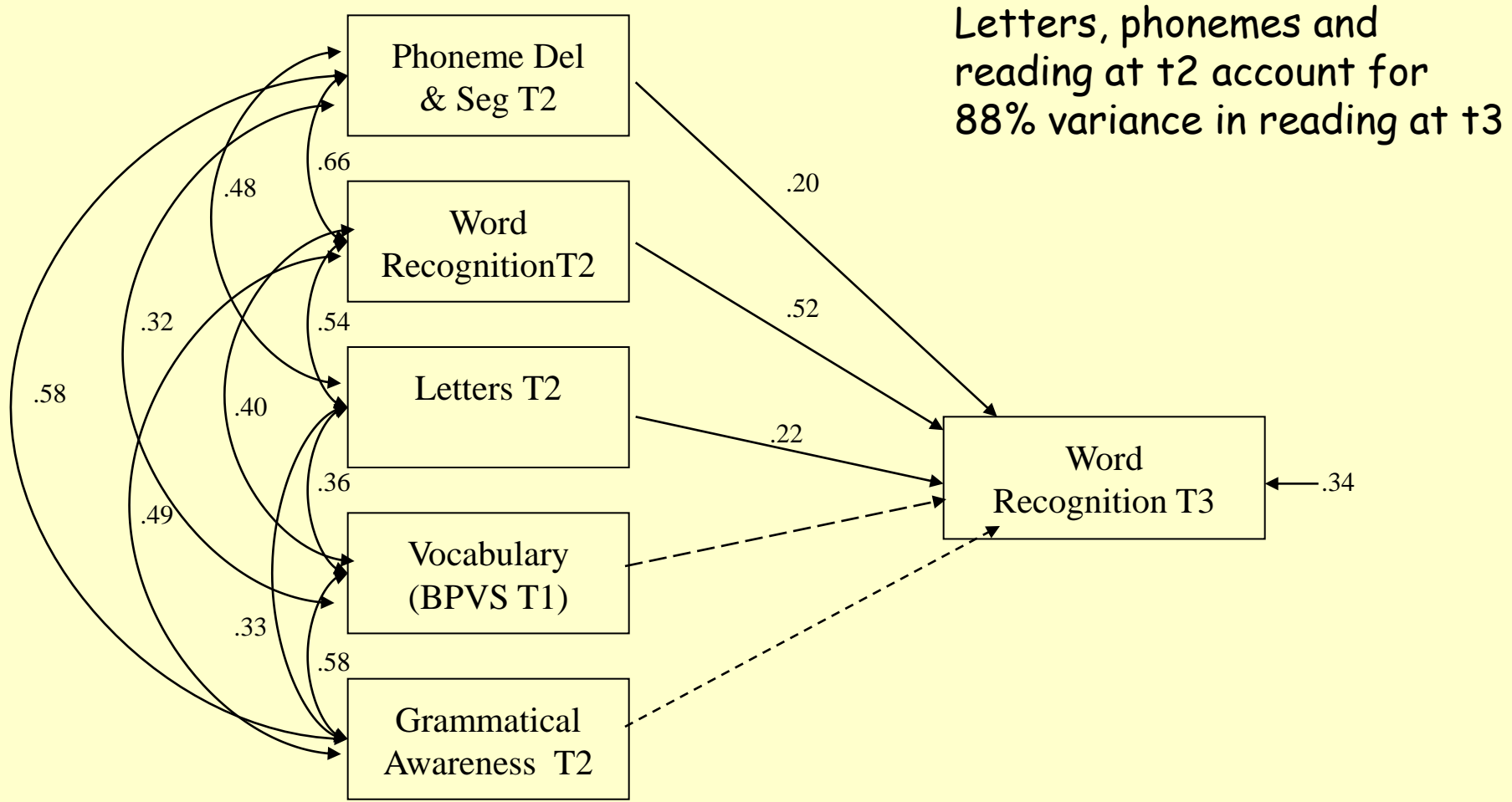
- It is now well established that phonological (speech sound) skills are critical for learning to read
- Learning to read in an alphabetic script requires the child to understand the alphabetic principle (Byrne) - that letters map onto phonemes “CAT” -
> /k/ /æ/ /t/
- Our view has been that children’s early *letter knowledge* and *phonemic* skills (the foundations of the alphabetic principle) are causally related to the development of reading skills

Muter, Hulme, Snowling & Stevenson

Developmental Psychology 2004

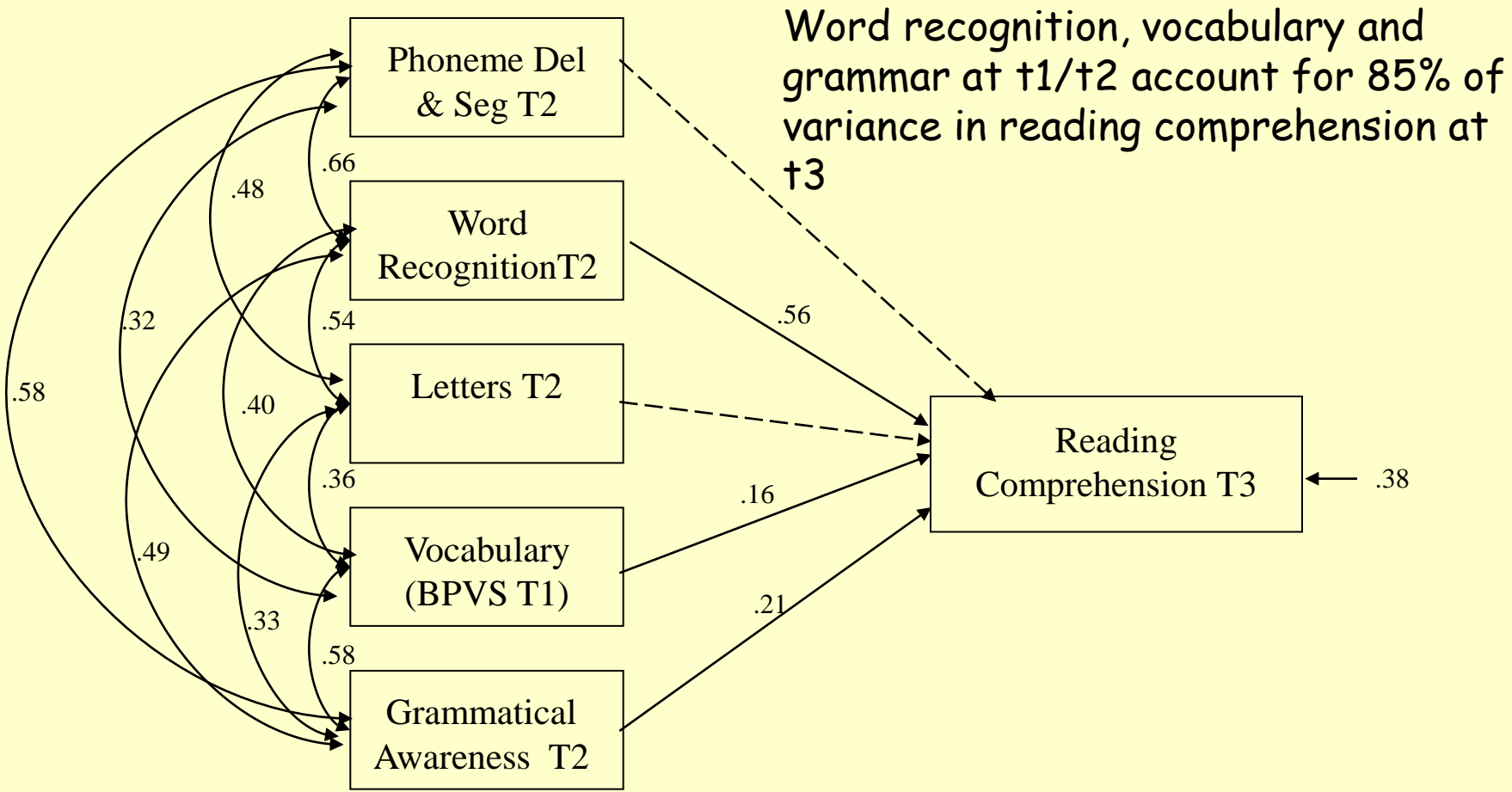
- Longitudinal study of 90 children
- 3 test times: at ages 4:09, 5:09, 6:09
- Measures: a large battery that included
 - Rhyme: Rhyme detection, Rhyme production, Rhyme oddity (Bradley)
 - Phoneme: Phoneme completion, Phoneme deletion beginning and end sound
 - Measures of verbal ability (BPVS) single word reading ability, letter knowledge (names or sounds) and grammatical awareness
 - Measures of grammatical sensitivity and reading comprehension also included

Word Recognition at T3 predicted from measures at T1 and T2



$\chi^2 (2, N=90) = 0.64, ns, CFI = 1.00, GFI = 0.998, RMSEA = 0.000 (CI_{.90} = 0.000 \text{ to } 0.149)$

Reading Comprehension at T3 predicted from measures at T1 and T2



$\chi^2 (2, N=90) = 3.92, ns, CFI = 0.992, GFI = 0.986, RMSEA = 0.104 (CI_{.90} = 0.000 \text{ to } 0.257)$

Summary - Theory

- Learning to read aloud (decode) – depends on letter knowledge and phoneme awareness (speech sound skills)
- Learning to comprehend - depends on “higher level” language skills (understanding of word meanings and grammatical structure)
- There are (at least) two forms of reading difficulty- Problems with decoding (dyslexia)
Problems with reading comprehension

Interventions for Decoding Difficulties



How do we demonstrate that an intervention works?

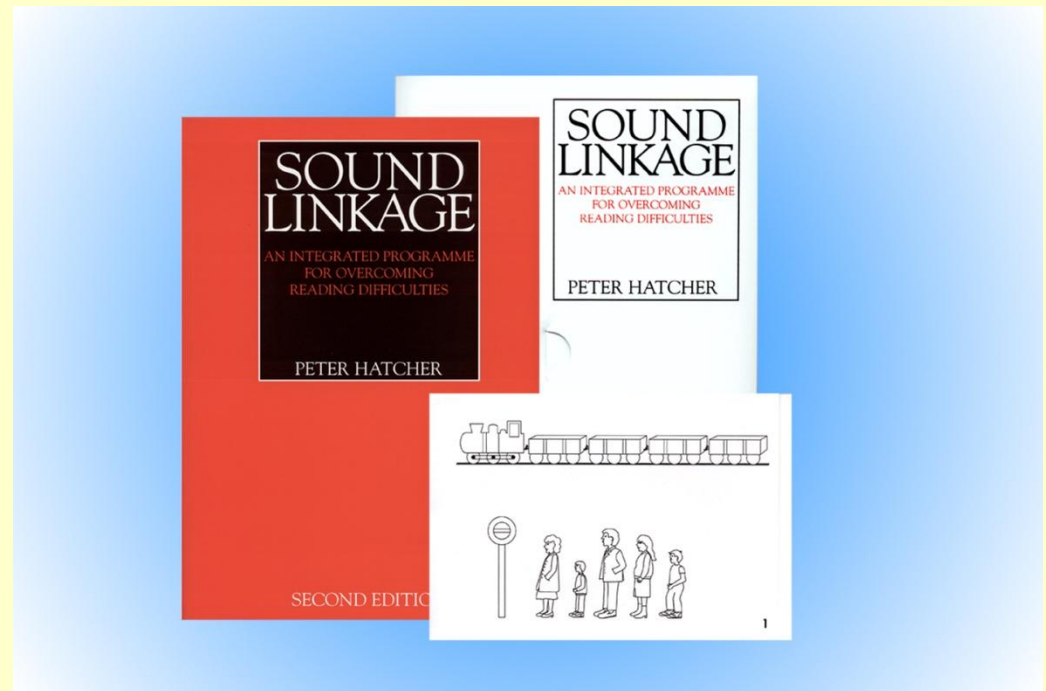
- We need “Experimental” or Randomised Controlled Trials (RCT)
- The basic idea here was worked out by Sir Ronald Fisher (1926) in the context of agricultural experiments (e.g. Crop yields and fertilizer)
- What is random in an RCT?
 - The assignment of people to treatments (or seeds to different levels of fertilizer!)

Why is Randomization Important?

- People may differ in innumerable ways in how likely they are to benefit from any treatment
- Randomly assigning people to treatments gives us the best chance of avoiding confounds that could bias the outcome of a study
- “randomisation relieves the experimenter from the anxiety of considering and estimating the magnitude of the innumerable causes by which his (*sic!*) data may be disturbed” (Fisher)
- The logic of randomized experiments started in agriculture, developed in medicine and is beginning to be widely applied in social and educational research

Hatcher, Hulme and Ellis (1994) – The Sound Linkage Hypothesis

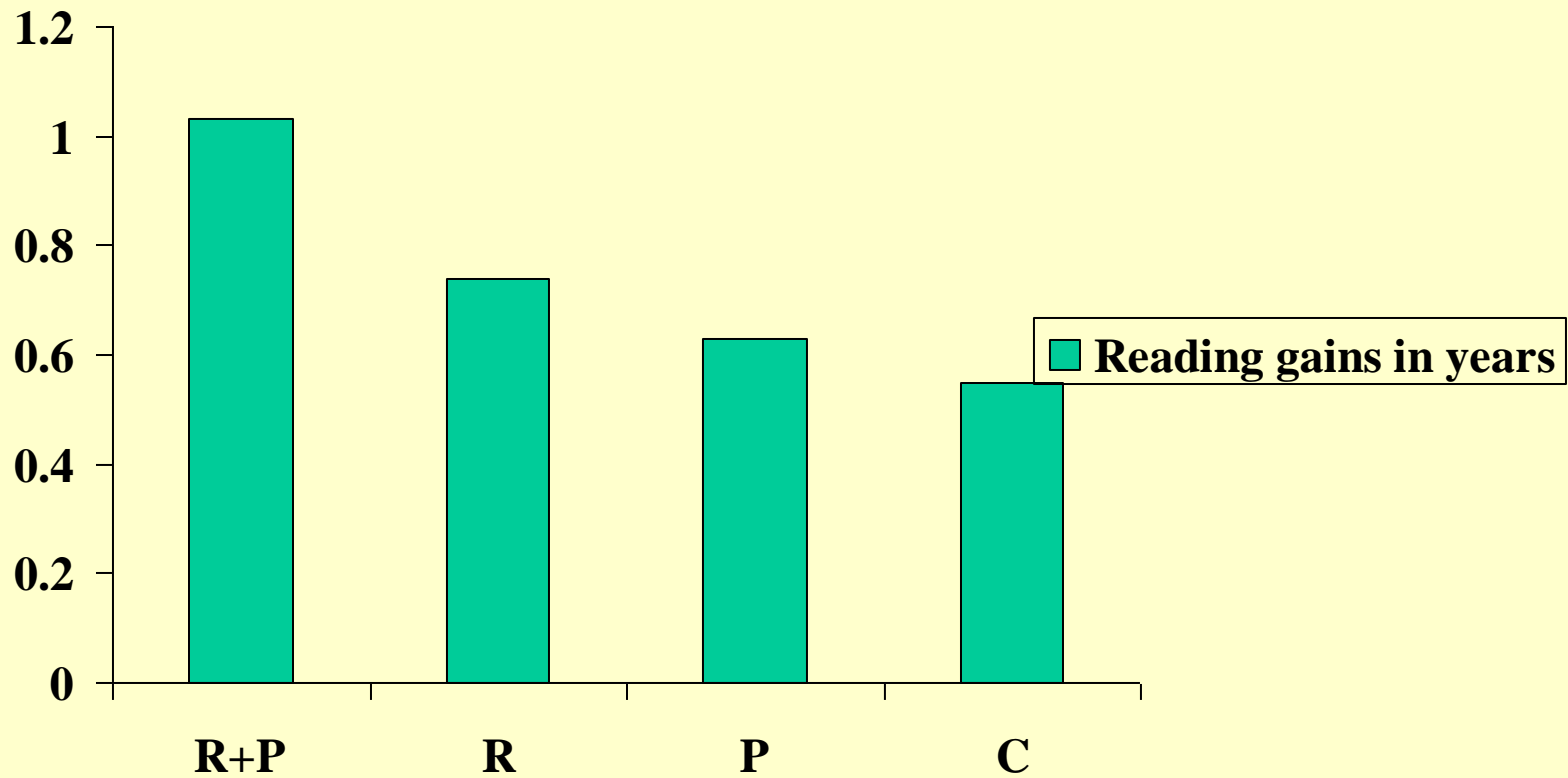
- Theory: HHE tested the idea that phonological training (broadly specified) needs to be linked with reading instruction to be effective
- Assigned four matched groups of reading-delayed 7.5-year-old children to one of three experimental conditions and to a control condition.
 - Reading alone (R)
 - Phonology alone (P)
 - Reading with phonology (R+P)
 - Control (C)



Hatcher, Hulme & Ellis (1994): The Sound Linkage Hypothesis

- In HHE all teaching was conducted by specially trained teachers – many with considerable experience of teaching children with reading difficulties
- Each teacher taught children in each of the 3 conditions (R, P, or R+P)
- Teachers were given extensive training and materials (particularly the graded books for children to read)
- Children received 2 individual 30 minute lessons each week, in school, for 20 weeks

Neale Analysis of Reading - Accuracy



Reading + Phonology Intervention

Sequence of Activities

1. - Re-reading an **easy book (>94% accuracy)**
 - Reading the book introduced in the previous lesson (Teachers take a "running record")
2. Letter identification
 - Phonological awareness training
 - Writing a story (Sound linkage activities)
 - [Cutting up a story]
3. Introduction to and Reading a **new book at instructional level (90 - 94% accuracy)**

Hatcher, Hulme & Ellis (1994):

Characteristics of the teaching procedures

- A critical aspect of the R+P programme is that it combines reading practice at the “easy” and “instructional” levels with letter-sound training and phonological awareness training
- The form of teaching is highly *structured* (prescriptive) but *individualized* to the level appropriate for a given child
- The use of a “running record” allows teachers to identify areas of difficulty for a particular child and target those areas in direct instruction

Hatcher, Hulme & Ellis (1994) – Conclusions

- Practice: with skilled individual teaching – failing 7-year old readers can be helped a great deal
- Theory: is not so simple – in order to be effective phonological training needs to be linked with reading instruction
- Theory: Hatcher and Hulme (1999) examined the predictors of reading progress in HHE, phonemes not rhyme predicted reading – a further refinement/complication to theory

Phonological training and the prevention of reading difficulties: The Cumbria Study

Hatcher, Hulme & Snowling
Journal of Child Psychology and
Psychiatry, 2004

Hatcher, Hulme & Snowling, 2004

- Hatcher, Hulme & Ellis (1994) showed that an individual, structured “phonological linkage” programme was highly effective in helping 7-year- old poor readers – can this approach be extended to teaching on a whole class basis?
- Will phoneme training be better than rime training?

The Cumbria study: Research questions

- We implemented a theoretically motivated ‘phonological linkage’ approach on a whole class basis in Reception and Year 1
- Three questions - will this approach:
 - have generally beneficial effects on literacy?
 - help to prevent the development of reading difficulties?
 - vary in effectiveness as a function of the level of phonological training that is targeted (phoneme vs. onset/rime training)

Cumbria Study Design

- Class teachers (Reception and Year 1) in 20 schools were trained to follow one of four highly structured methods of teaching reading (Phonic Reading alone or in combination with phonological awareness training)
- 20 classes divided into four groups and randomly assigned to:
 - Phonic reading (PR)
 - PR + Rhyme
 - PR + Phoneme
 - PR + Rhyme + Phoneme

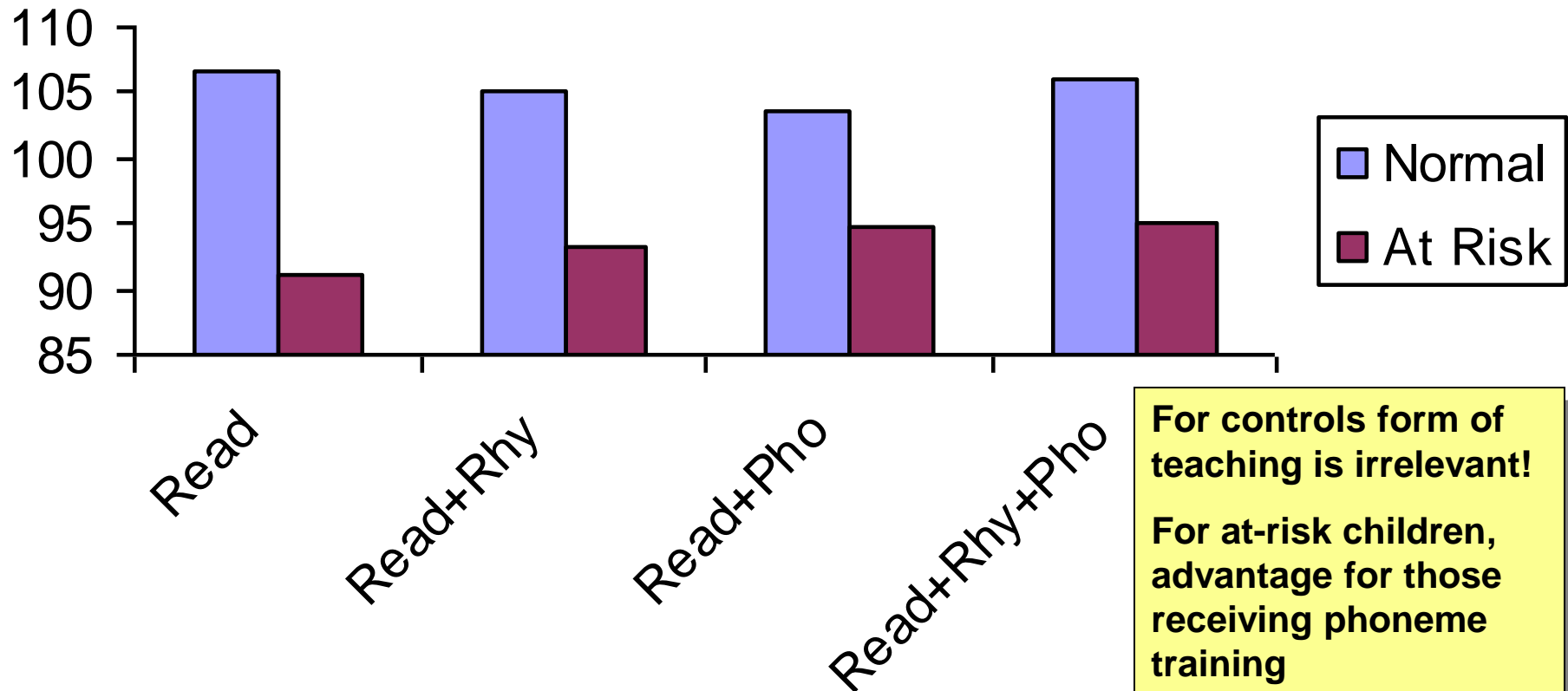
	Reading Alone	Reading +Rhyme	Reading +Phoneme	Reading +Rhyme +Phoneme
Reading				
Concepts about print ✓		✓	✓	✓
Letter identification ✓		✓	✓	✓
Word reading ✓	✓	✓	✓	✓
Phonics ✓	✓	✓	✓	✓
Writing ✓	✓	✓	✓	✓
Spelling ✓	✓	✓	✓	✓
Text reading ✓	✓	✓	✓	✓
Sound Linkage ✓	✓	✓	✓	✓
Explicit Training in Phonological Awareness And Linkage				
Word identification		✓	✓	✓
Syllable identification		✓	✓	✓
Rhyme supply		✓		✓
Onset-rime linkage		✓		✓
Phoneme blending and linkage			✓	✓
Phoneme discrimination			✓	✓
Phoneme segmentation and linkage			✓	✓
Phoneme deletion and linkage			✓	✓
Phoneme substitution and linkage			✓	✓
Phoneme transposition and linkage			✓	✓

Study design

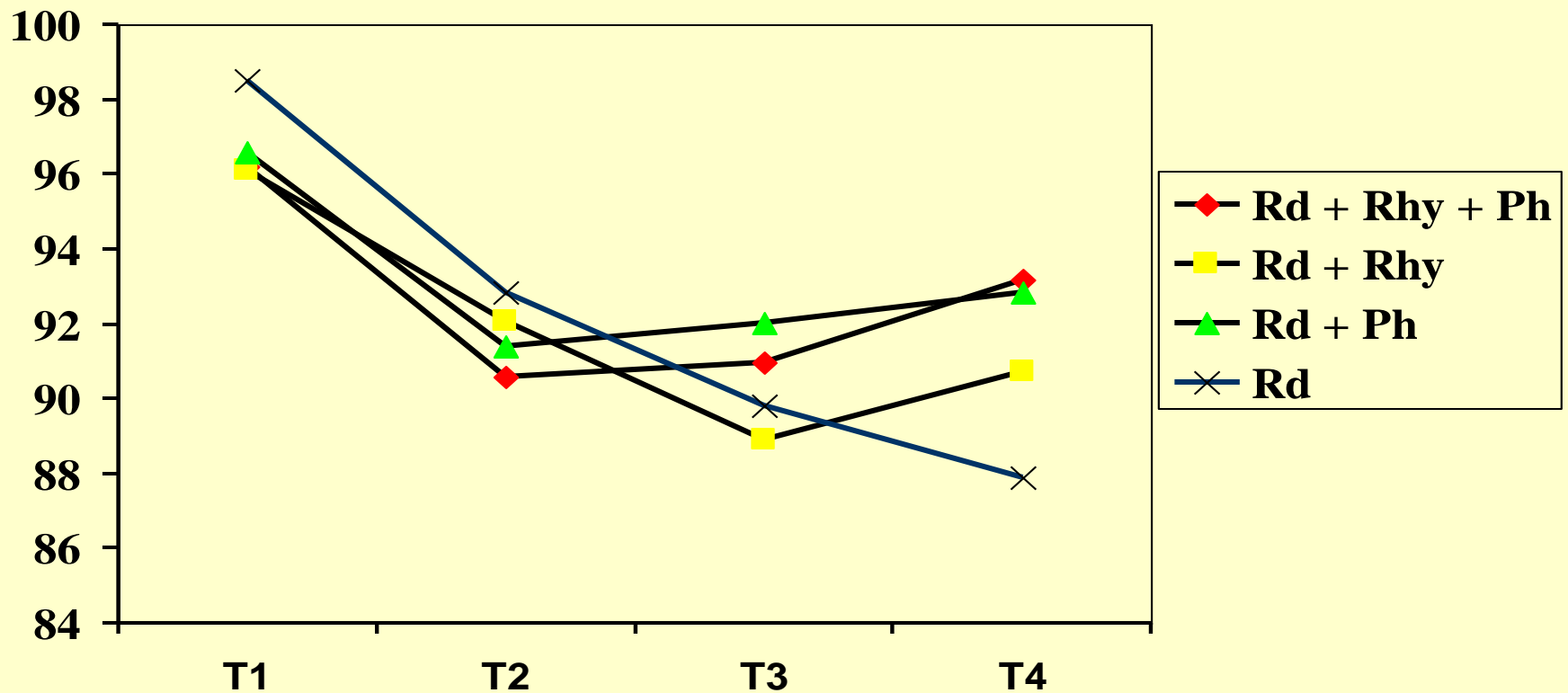
- **Times of assessment**
 - t1 October to November Yr 1 (aged 4.64 yrs)
 - t2 June to July Yr 2 (aged 5.24 yrs)
 - t3 June to July Yr 3 (aged 6.21 yrs)
 - t4 January to March Yr 4 (aged 6.92 yrs)
- Intervention occurred between t1 and t3 - throughout the first two years of formal education (Reception and Year 1)

Word Reading Normed Standard Scores

Word Reading SS T4



Relative decline in word reading for at-risk children



The Cumbria study – Our three questions

- Is teaching involving “phonological linkage” generally beneficial for literacy?
 - No (average reading levels are good in all conditions for the normally developing children, but there are no additional benefits from phonological linkage training in these children)
- Does such teaching help to prevent the development of reading difficulties?
 - Yes - but only to the extent that it slows the decline in reading standards in children at-risk of reading failure, it does not overcome such difficulties
- Does the level of phonological training that is targeted (phoneme vs. onset/rime training) matter?
 - Yes – children who are at-risk of reading failure show greatest benefits when training targets phoneme skills

Phonological training and the prevention of reading difficulties: The North Yorks Study

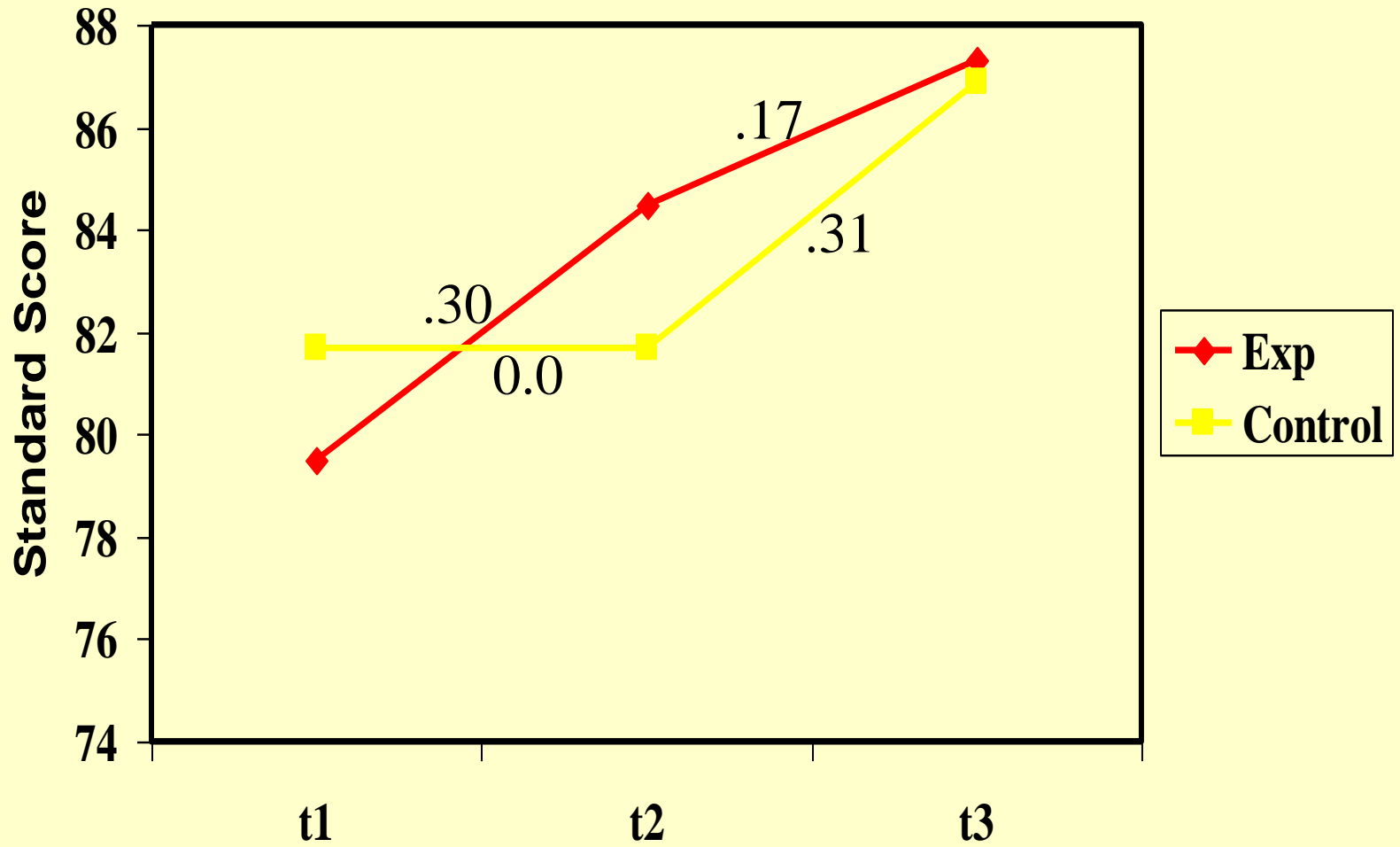
Peter J. Hatcher, Margaret J.
Snowling, Charles Hulme, Julia
Carroll, Claudine Crane, Janet
Hatcher, Simon Gibbs & Glynnis
Smith

North Yorks study: Research question

- Will a modified version of the HHE programme, administered by trained **Teaching Assistants**, work with **small groups** (N=3) of Year-1 children who might be at risk of reading delay?

North Yorks study: Design

- Year-1 children, with weak spelling skills, were selected from 12 schools for an individual assessment of their literacy skills
- Based on a composite score, six children, with the weakest literacy skills, from each school were randomly allocated to an Experimental or Control condition (with 3 children in each group within each school)
- The Experimental condition received RI for 10 weeks in Term 2 and again in Term 3
- The Control condition received RI for 10 weeks in Term 3



Experimental group gained 7.8 SS points in 33.3 hours (.23 ss pts/hr)

Treatment Non-Responders

- Over the course of NY Reading Intervention, 21% of children showed no gain in reading standard scores
 - 9/39 from the 20-week intervention group
 - 12/38 from the 10-week waiting control group
- Two factors were independent predictors of level of responsiveness to reading intervention
 - Level of phoneme awareness prior to intervention
 - Receipt of free school meals

Improving early language and
literacy skills: Differential
effects of an oral language versus
a phonology with reading
intervention

Bowyer-Crane et al.

JCPP, 2008

Nuffield Early Intervention Project

- Evaluation of two interventions designed for children with speech and language difficulties in mainstream schools to be delivered by trained teaching assistants (TAs)
- Oral Language Programme
- Phonology with Reading Programme
- Randomised Controlled Trial (following the Consort guidelines)
- 20-week programme
- 4 test phases: pre-test, mid-test, post-test and maintenance test
- Investigators blind to group membership

Structure of the Programmes

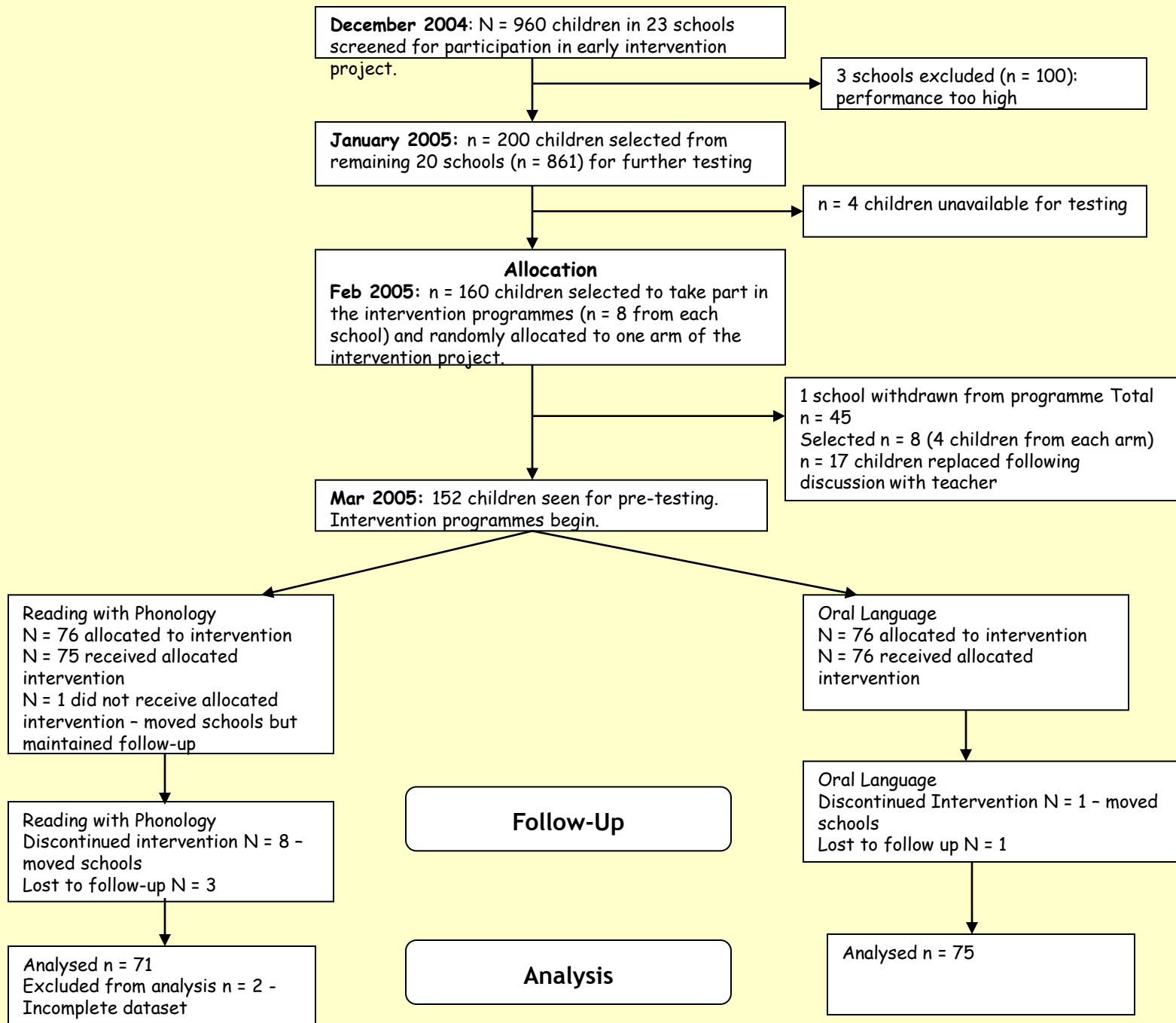
- Programmes conducted over 2 x 10 week periods
- Following initial introduction week, teaching was broken into 3 week blocks consisting of two teaching weeks and one consolidation week
- Each week consisted of alternating daily group sessions or individual sessions
- Repetitive session structure – familiar routine, positive reinforcement

Programmes

- Oral Language
 - Vocabulary development
 - Speaking
 - Listening
 - Narrative production
 - Comprehension
 - Question generation
- Reading with Phonology
 - Training in letter sound knowledge (Jolly Phonics)
 - Oral phonological awareness
 - Reading books at easy and instructional levels
 - Sight word vocabulary development
 - Letter formation

Programmes

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Participants (N = 152)

Time 1 Measures	Oral Lang Grp N = 76	R + P Group N = 76	F	Sig
Age (months)	55.58 (3.32)	56.30 (3.51)	1.70	ns
Block Design (scaled)	6.86 (3.23)	6.92 (2.98)	.017	ns
Verbal Composite (scaled)	7.16(1.91)	6.95 (1.86)	.44	ns
Letter Knowledge	14.12 (6.06)	13.69 (6.72)	.167	ns
EWR	3.04 (3.55)	4.88 (7.00)	4.19	p<.05
Phonetic Spell	13.13 (11.78)	12.80(13.43)	.026	ns
NonWord Rep	3.50 (2.46)	3.71 (2.86)	.227	ns
Sound Isolation	8.30 (7.72)	7.49 (7.81)	.410	ns
Articulation	7.26(2.33)	6.91 (3.56)	.529	ns
Listening Comp	1.70 (1.36)	1.63 (1.40)	.086	ns
Bus Story Info	13.69 (6.32)	12.44 (6.99)	1.31	ns
Bus Story Sen Len	7.19 (2.01)	6.79 (2.27)	1.29	ns
APT Info	25.13 (5.46)	24.28(5.53)	.892	ns
APT Grammar	16.70 (5.47)	15.75 (6.05)	1.03	ns

Measures

Language Skills

- Reading Comprehension
- Listening Comprehension
- Specific Vocabulary
- Action Picture Test
- Bus Story
- WISC III Picture Arrangement
- Information Carrying

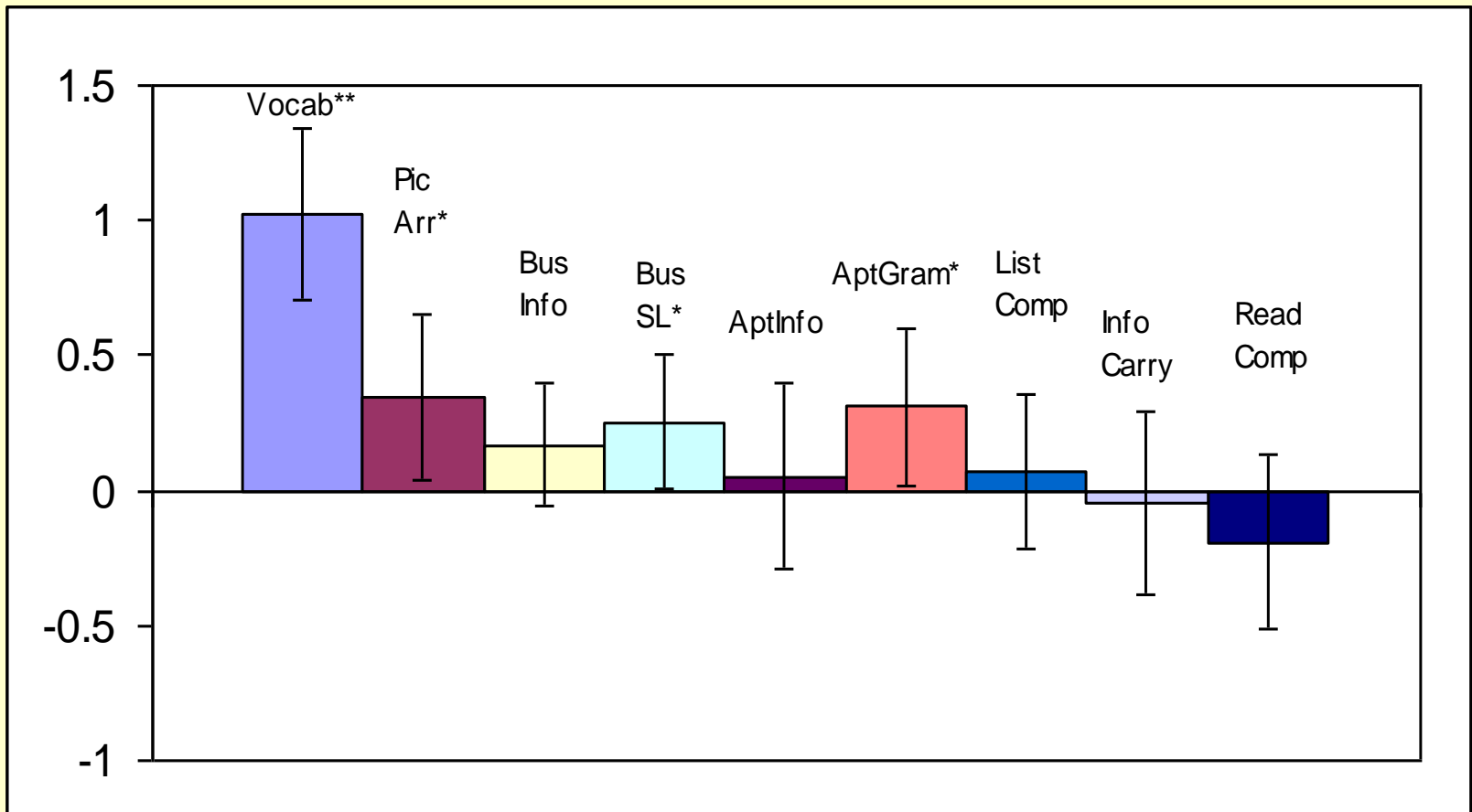
Reading and Phonological Skills

- Early Word Reading
- Letter Knowledge
- Spelling
- Reading Accuracy
- Segmenting and Blending
- Sound Isolation
- Articulation

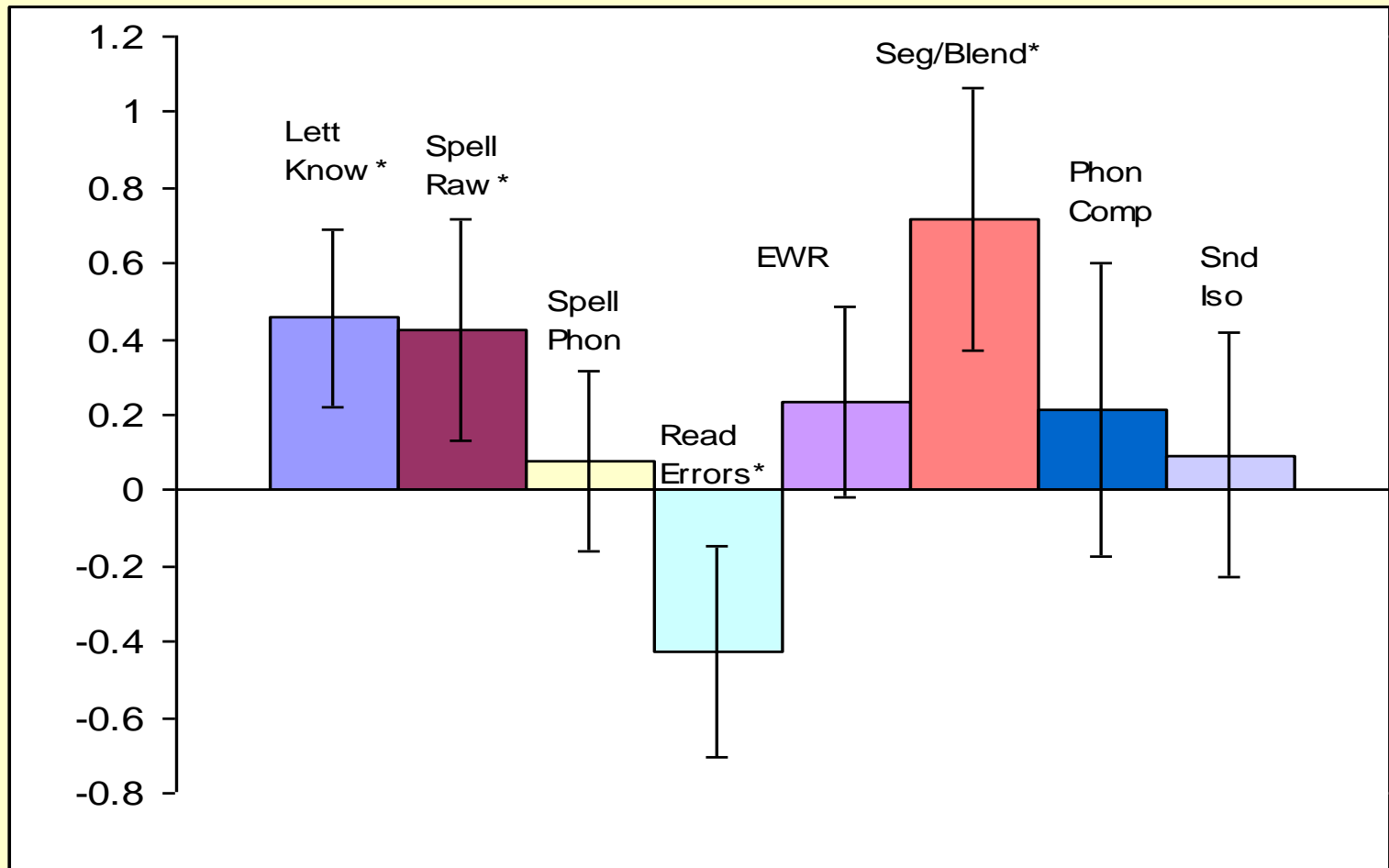
Mode of Analysis

- Data are clustered: 4 children per arm; two arms delivered by each TA
- Sandwich estimators used to give robust CIs
- Primary outcomes
 - Vocabulary
 - Grammar
 - Phoneme Awareness
 - Letter Knowledge
 - Word Recognition
 - Reading Comprehension
- Assess effect of Group, after controlling relevant covariates: Age, Gender, Autoregressor (when available)

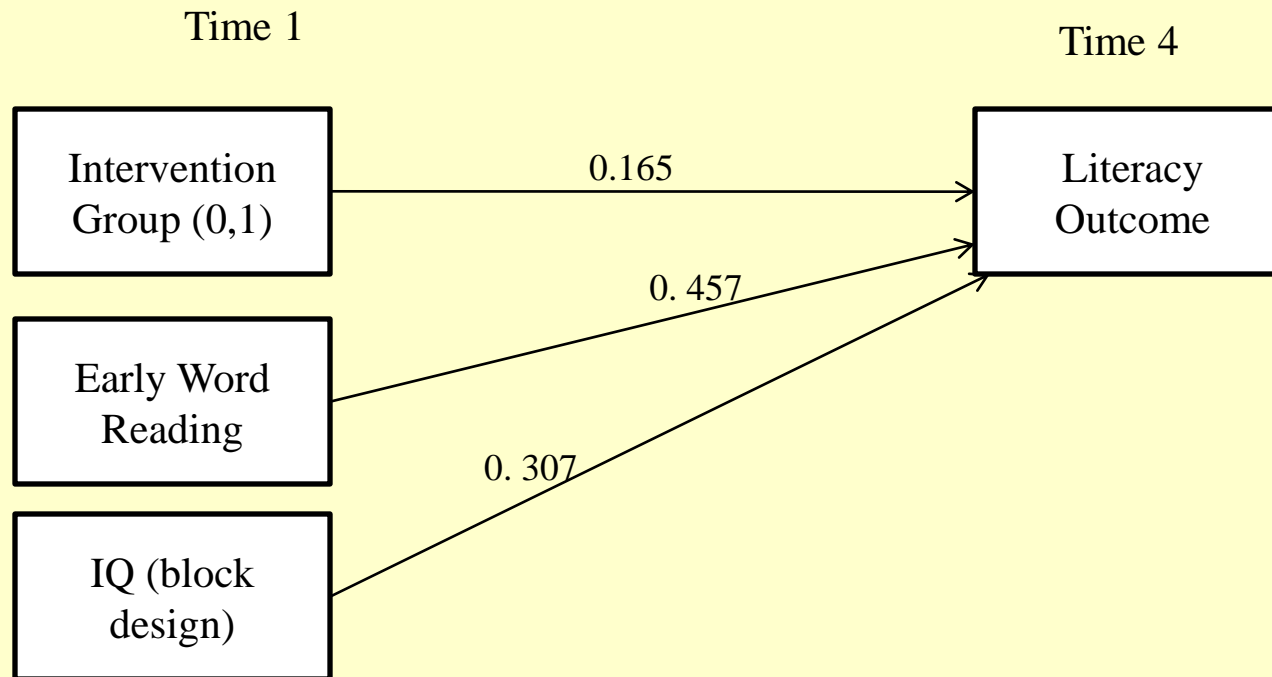
Relative Advantage of Language Group at T3 in z-score units (95% CIs)



Relative Advantage of Reading with Phonology Group at T3 in z-score units (95% CIs)

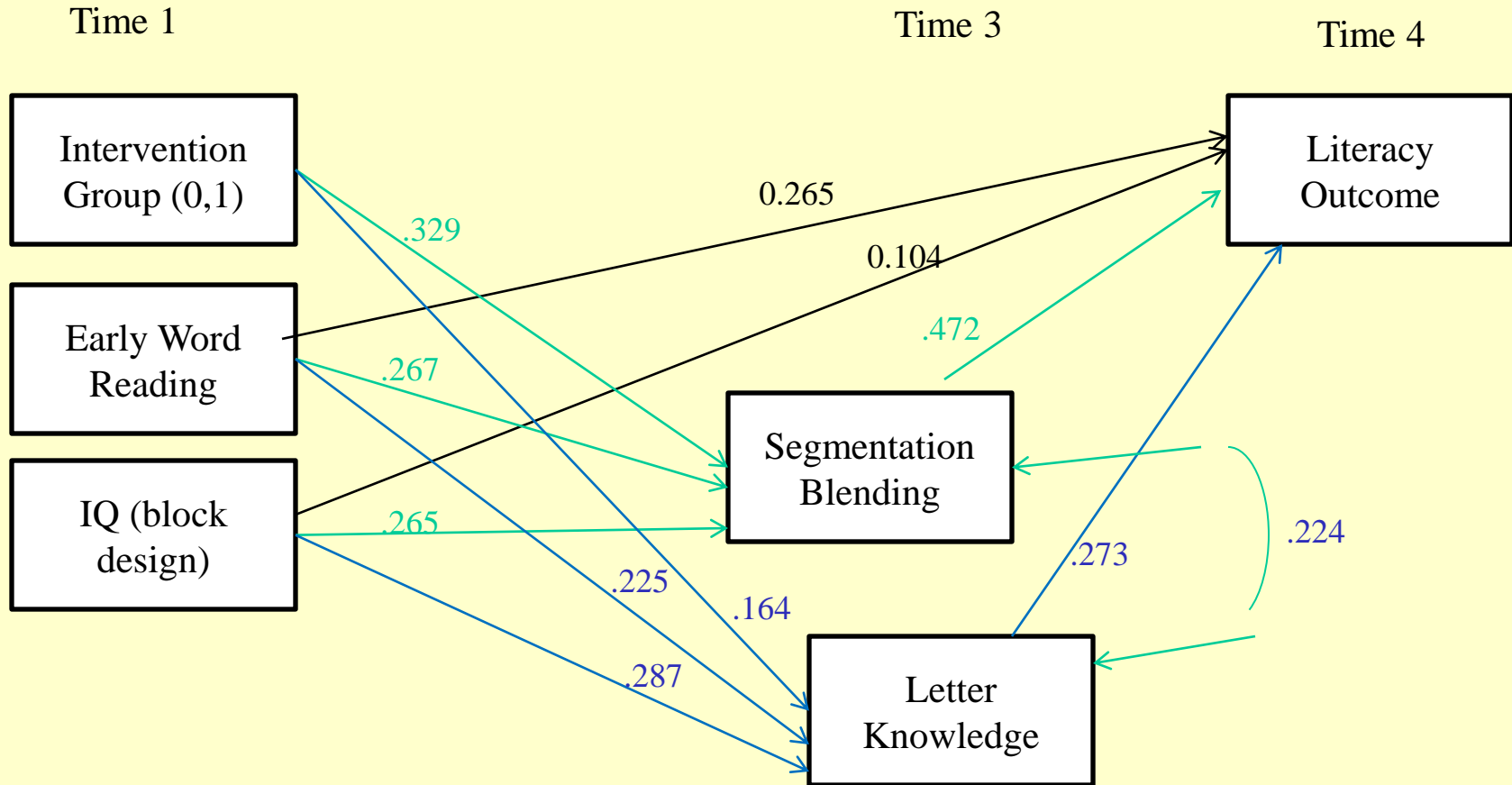


Is intervention effective?



This path model is an Analysis of Covariance, controlling for 2 covariates (reading and IQ). This shows that the effect of Intervention is reliable after controlling for initial reading skills and IQ

What causes the 'increase' in reading skill?



Chi sq = .86, df. 1 NS; CFI 1.0; RMSEA 0.00 (0-.208)

Literacy outcome is entirely mediated by these two variables . Dropping direct effect of group has no effect on fit indices of model
R2 for Literacy 67% ; Total indirect effects on Literacy 4.0%; I ndirect effect Grp->Seg/Bl3-> Lit 2.4%; Indirect effect Grp->LK3-> Lit 0.2%. Both indirect effects are reliable

Summary

- Both P+R and OL intervention programmes were effective in promoting basic skills that underlie reading comprehension
 - Vocabulary and grammatical skills fostered better by OL program
 - Word-level reading skills, phoneme awareness and spelling fostered better by P+R programme
- Effects maintained 5 months after intervention ceased.
- Gains in phoneme awareness and LK generalized to nonword reading at t4
- Reading skills brought to within the average range for children given the P+R programme at t4

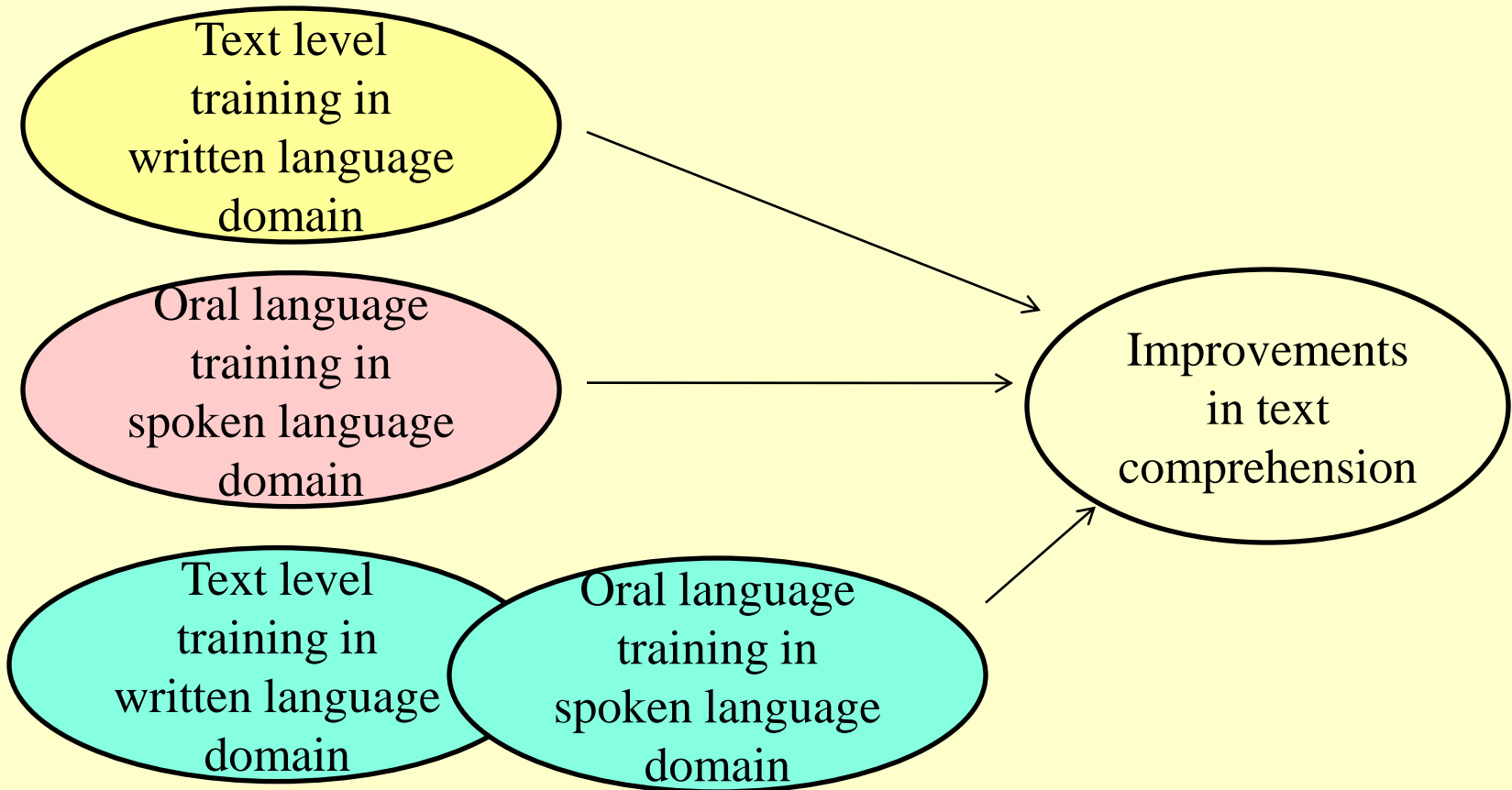
The York READING for Meaning Project

The Effects of Three Interventions to Support Reading Comprehension in Poor Comprehenders



Paula Clarke, Charles Hulme,
Emma Truelove, Maggie Snowling

Design

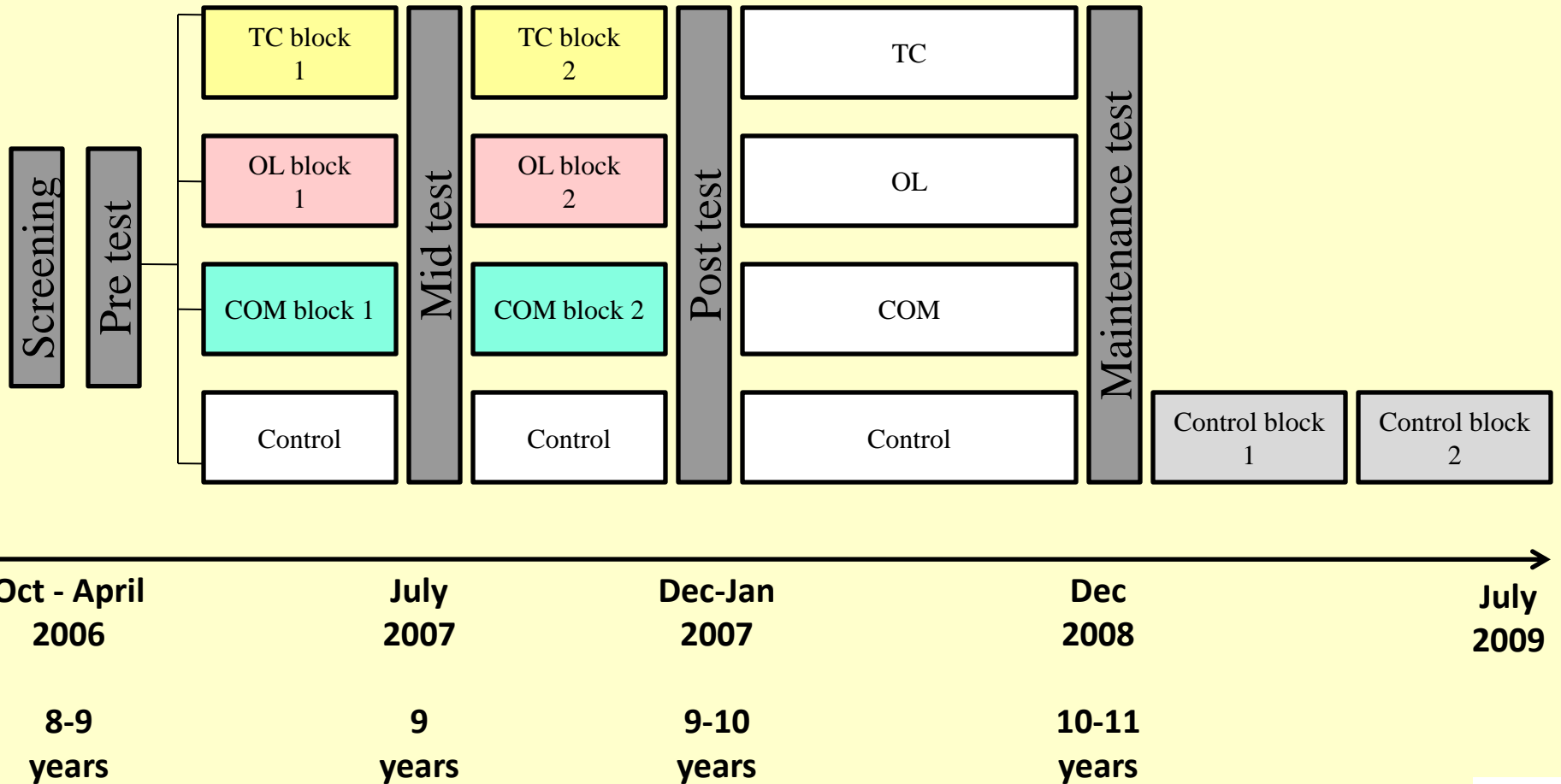


Project aims

- To compare three different interventions to existing classroom practice by monitoring the performance of an untreated waiting control group (4 group RCT)
- To explore the effectiveness of the three approaches in the immediate and long term.
- To examine mediating factors that influence response to intervention.



Randomised Controlled Trial Design



Participant profile

	Group 1 (n=40)	Group 2 (n=40)	Group 3 (n=40)	Group 4 (n=40)	Whole sample (n=160)
TOWRE Real words	110.48	108.88	108.30	108.70	109.09
NARA II Reading accuracy	102.93	102.93	104.33	101.55	102.93
NARA II Reading comprehension	92.95	93.36	92.82	92.82	92.99
WIAT II Reading comprehension	94.31	95.43	96.38	97.77	95.96
CELF Listening comprehension	78.75*	80.42	87.36*	83.06	82.40
WASI Vocabulary (t score)	38.31	40.32	39.44	38.26	39.07
WASI Similarities (t score)	47.40	49.05	49.97	49.49	48.97
WASI VIQ	89.41	92.03	91.89	91.00	91.07
Ravens Matrices NVIQ	99.26	100.23	100.66	100.78	100.23

16.1

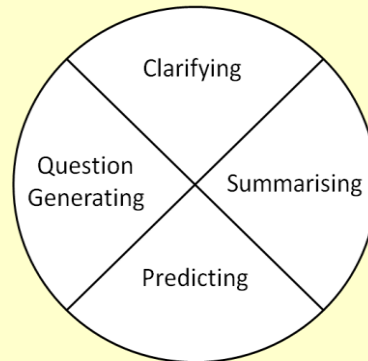
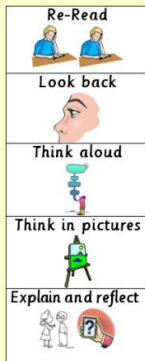
*Statistically significant between groups difference ($p < 0.05$)



Programme contents and features

Text Comprehension

Written Language Context

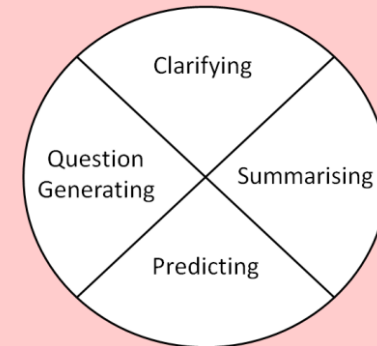
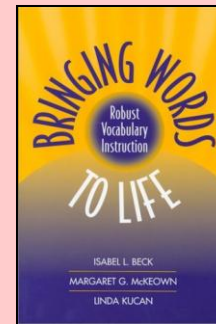


Reading Comprehension
Metacognitive Strategies
Inferencing from Text
Narrative



Oral Language

Spoken Language Context



Listening Comprehension
Vocabulary
Figurative Language
Narrative

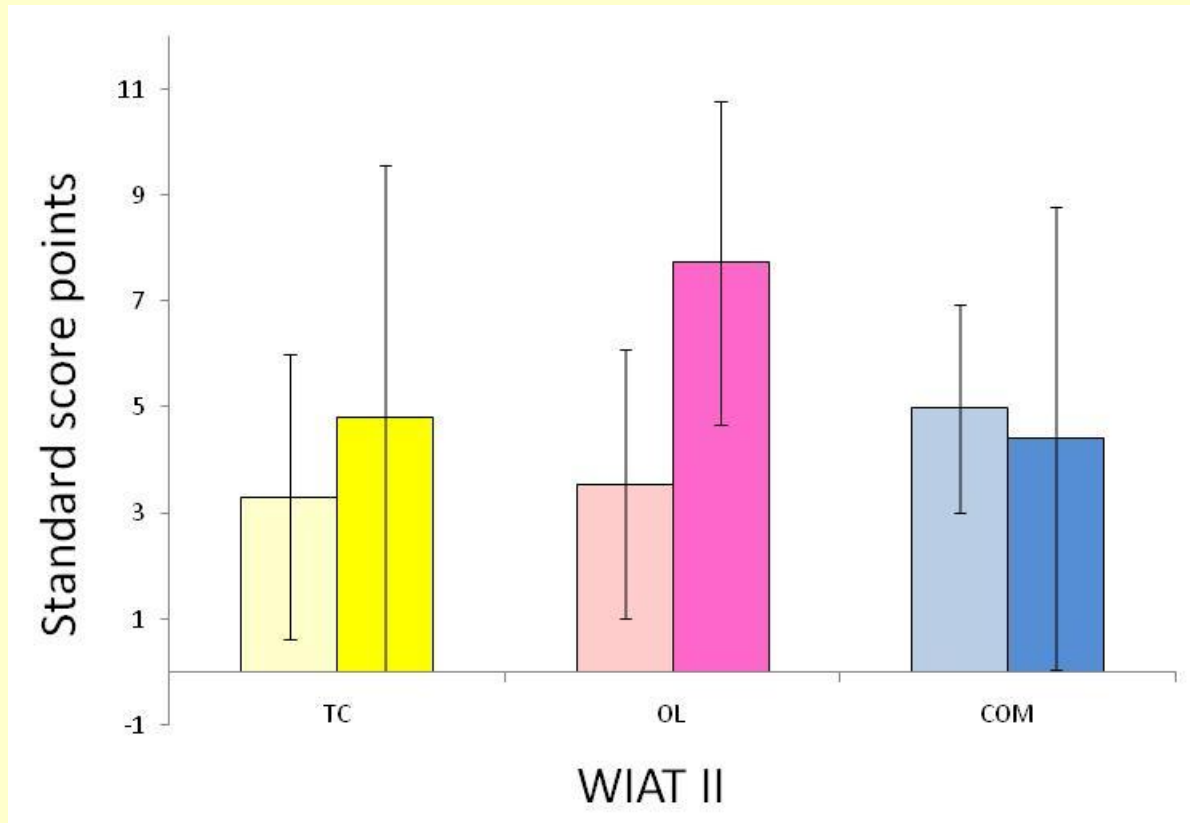


Combined

- All eight components
- Sessions contained both reading and listening comprehension
- Opportunities for children to encounter new vocabulary/idioms/inferences in both written and spoken language.



Primary outcome – ANCOVA Text comprehension

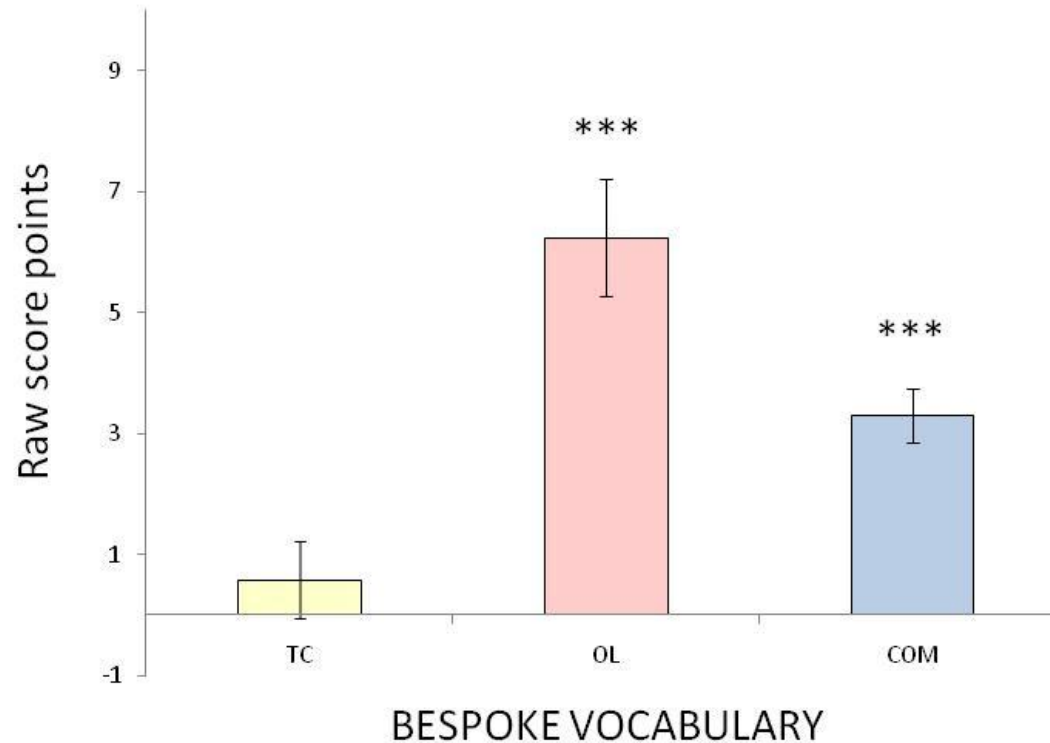


pale = immediate post test
bright = maintenance post test (12 mth)

- Children read (aloud or silently) a range of passages and sentences. (narrative, adverts, non-fiction information etc.)
- Includes literal, inference and vocabulary dependent question types.
- Also involves summarisation (finding key themes and ideas), prediction, and question generation.



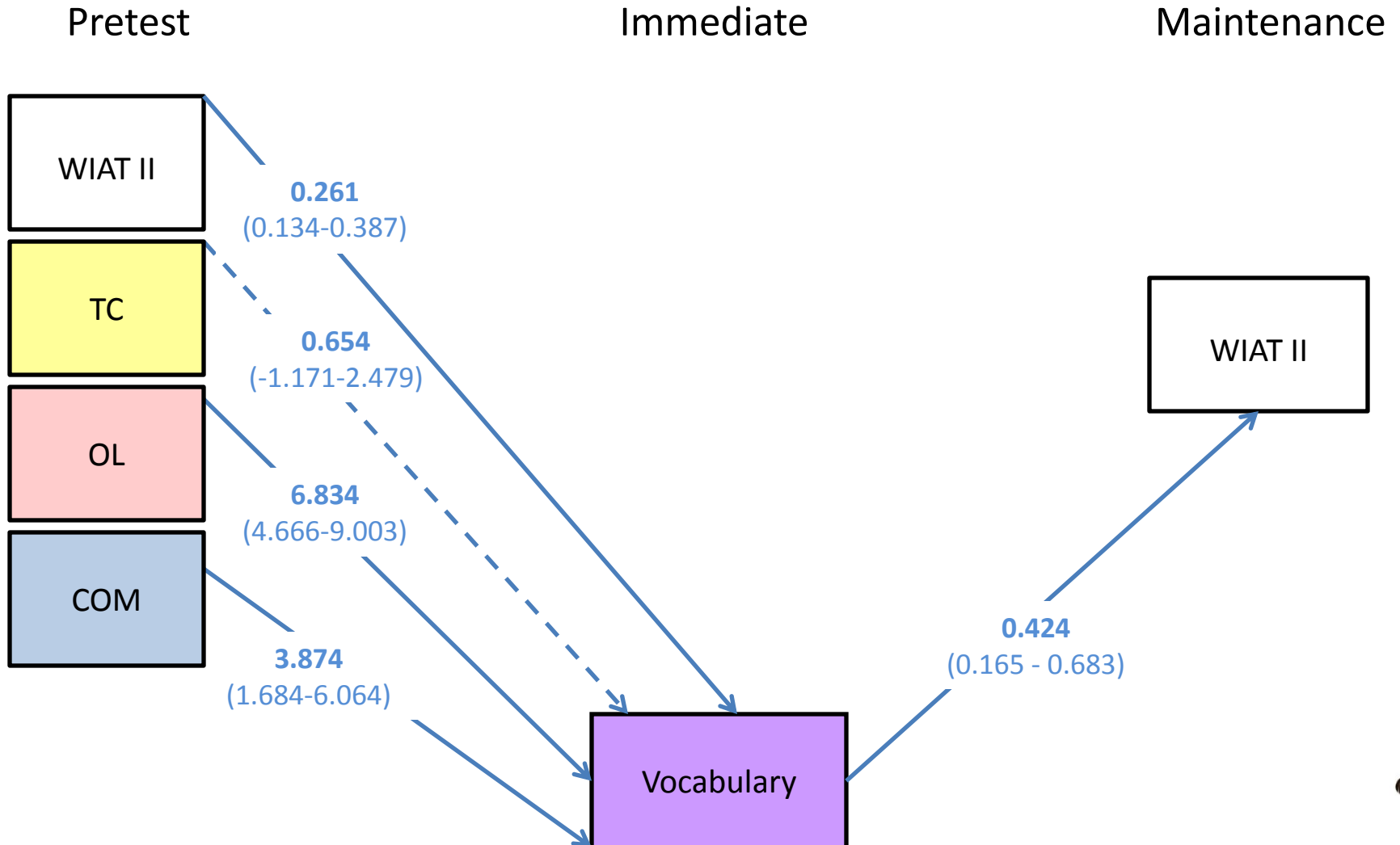
Secondary outcome - Vocabulary



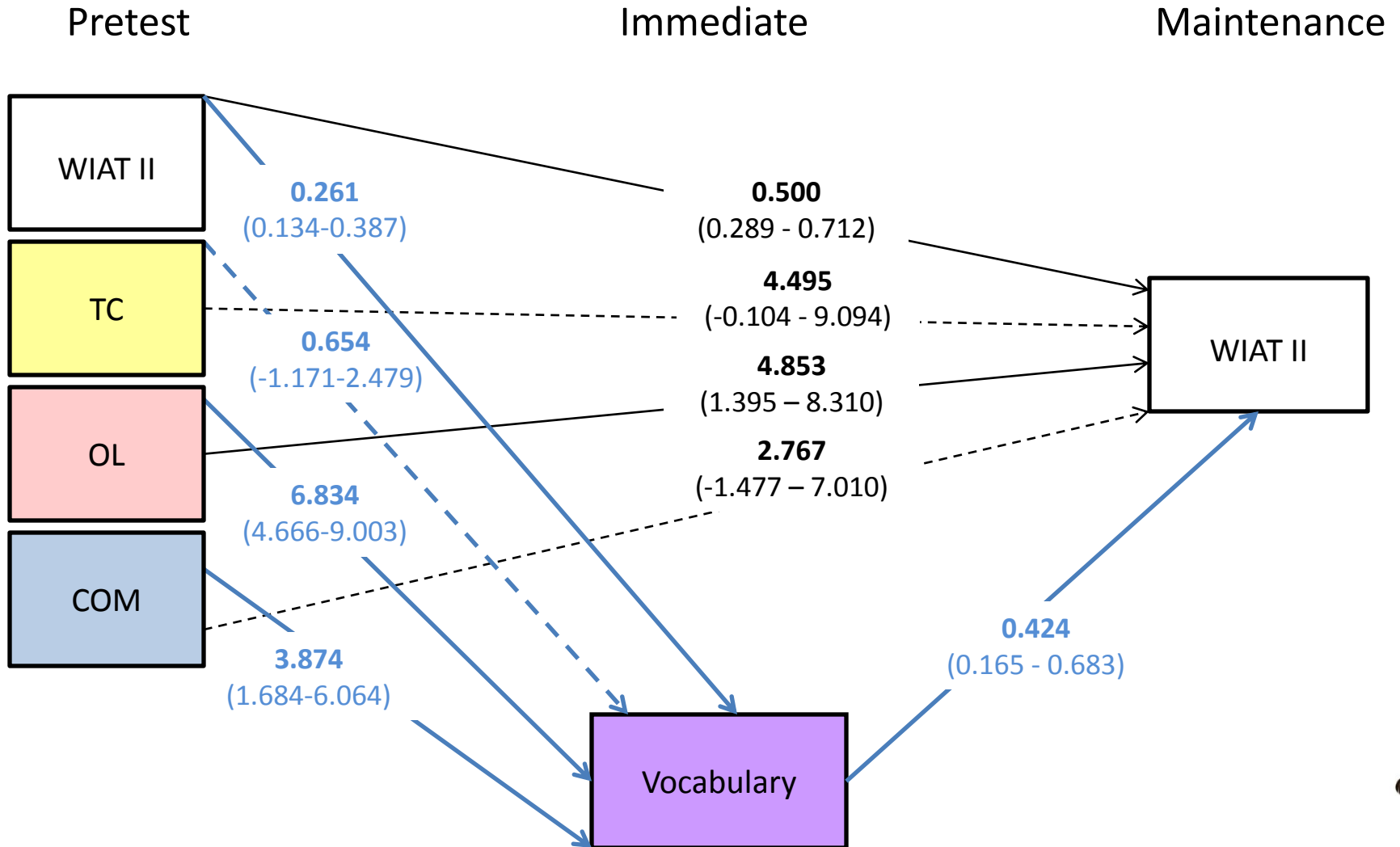
- Children orally define a series of tier 2 words (AoA 13 years +, unfamiliar but applicable to a number of contexts)
- Half of the words are those targeted in the OL and COM interventions and half are non targeted.
- Definition quality is quantified using a 0,1,2 scoring system, developed from pilot study responses.



Mediation model



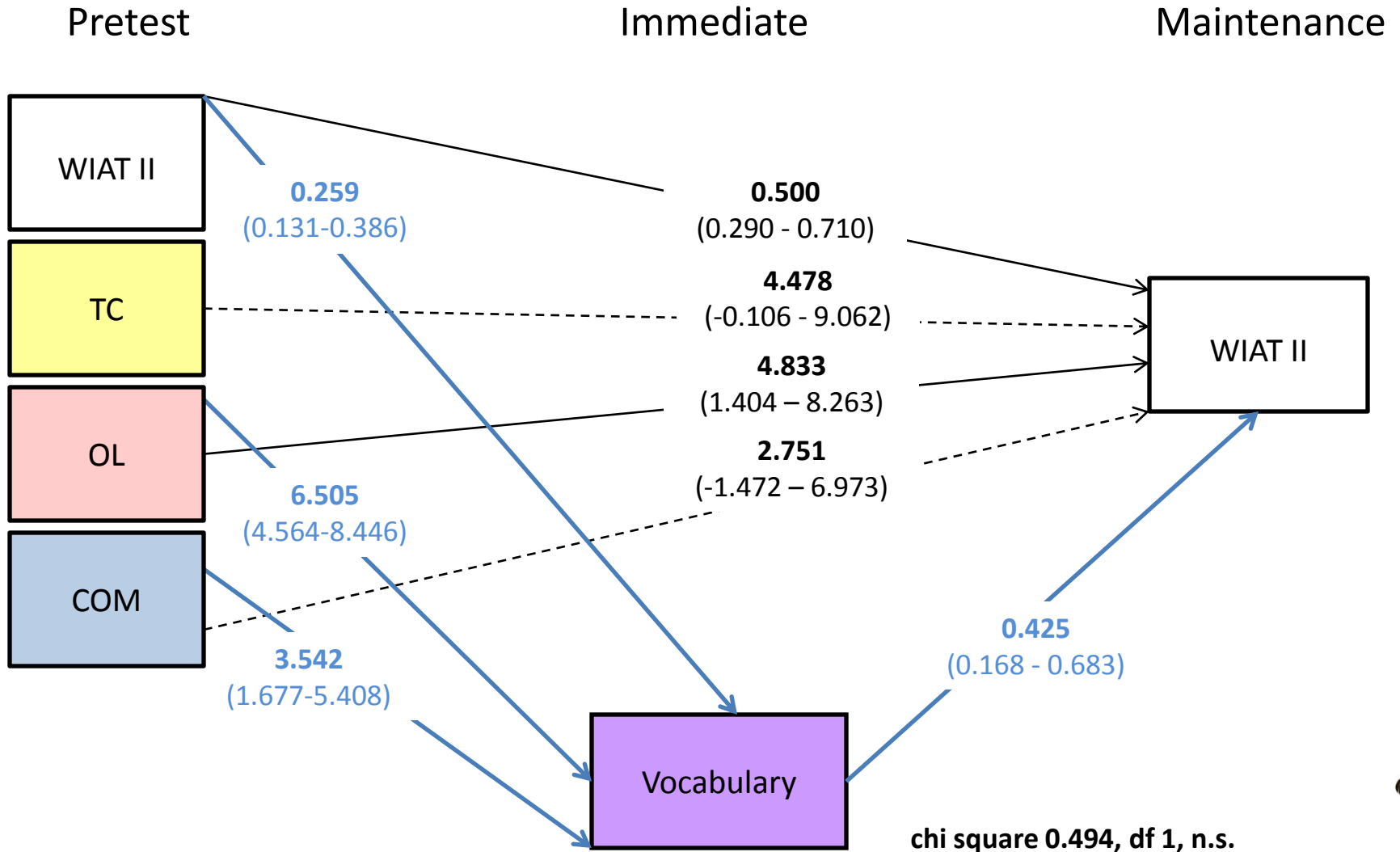
Mediation model



saturated model



Mediation model



Summary & Conclusions

- Our RCT shows that all 3 of our 20-week intervention programmes produce significant gains in text comprehension and oral language that are maintained 12 months after the intervention has finished. Impressive!!
- The long-term gains are largest in the OL condition (and actually increase between the end of the intervention and maintenance testing 12 months later).
- The gains in text comprehension are fully mediated by vocabulary learning in the COM condition and partially mediated in the OL condition (and NOT mediated by Vocabulary in the TC condition – where vocabulary teaching was not included)
- Broadly, these results are consistent with the view that underlying Oral Language deficits in Poor Comprehenders are causally related to their Reading Comprehension problems
- More specifically, the mediation models support the idea that the changes in Reading Comprehension produced by the OL and COM programmes are at least partly brought about by improvements in Vocabulary knowledge – which may be one critical source of the difficulties seen in Poor Comprehenders



Implications

- The skills that underpin oral language and text comprehension are trainable in children aged 8-11 years.
- Evidence to suggest a causal relationship between Oral Language deficits and text comprehension.
- Improvements in text comprehension can be explained, at least in part, by improvements in vocabulary skill.



General Conclusions

- Learning to read builds on a oral language skills
- There are at least two forms of reading problems: Decoding and Reading Comprehension problems
- Decoding depends critically upon phonology- particularly the development of phoneme skills and letter knowledge
- Interventions that promote letter knowledge and phonemic skills are highly effective in developing decoding
- Oral language based interventions appear to be effective for improving oral language and reading comprehension
- Interventions should not be seen as a “quick fix” – many children will require ongoing support throughout their school lives to cope with literacy difficulties



Handbooks of Developmental Psychology

THE SCIENCE OF READING

A Handbook



Edited by **Margaret J. Snowling** & **Charles Hulme**

 **Blackwell**
Publishing