

# **Evaluation of Early Reading Intervention Knowledge (ERIK)**

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# The literacy learning profile for each student

What international research says reading comprehension looks like

Two dimensions of reading comprehension

Simple View of Reading (Gough & Tunmer, 1985) can guide understanding reading comprehension:

*Reading comprehension = Decoding x Oral language comprehension*

phonics, decoding  
fluency,

Listening comprehension

# Simple view of reading : later modifications

This relationship can progressed through various iterations and is still seen internationally as important in unpacking reading comprehension

$$RC = D \times OL \times SE \times MC \times CV$$

word reading skills

Oral language knowledge

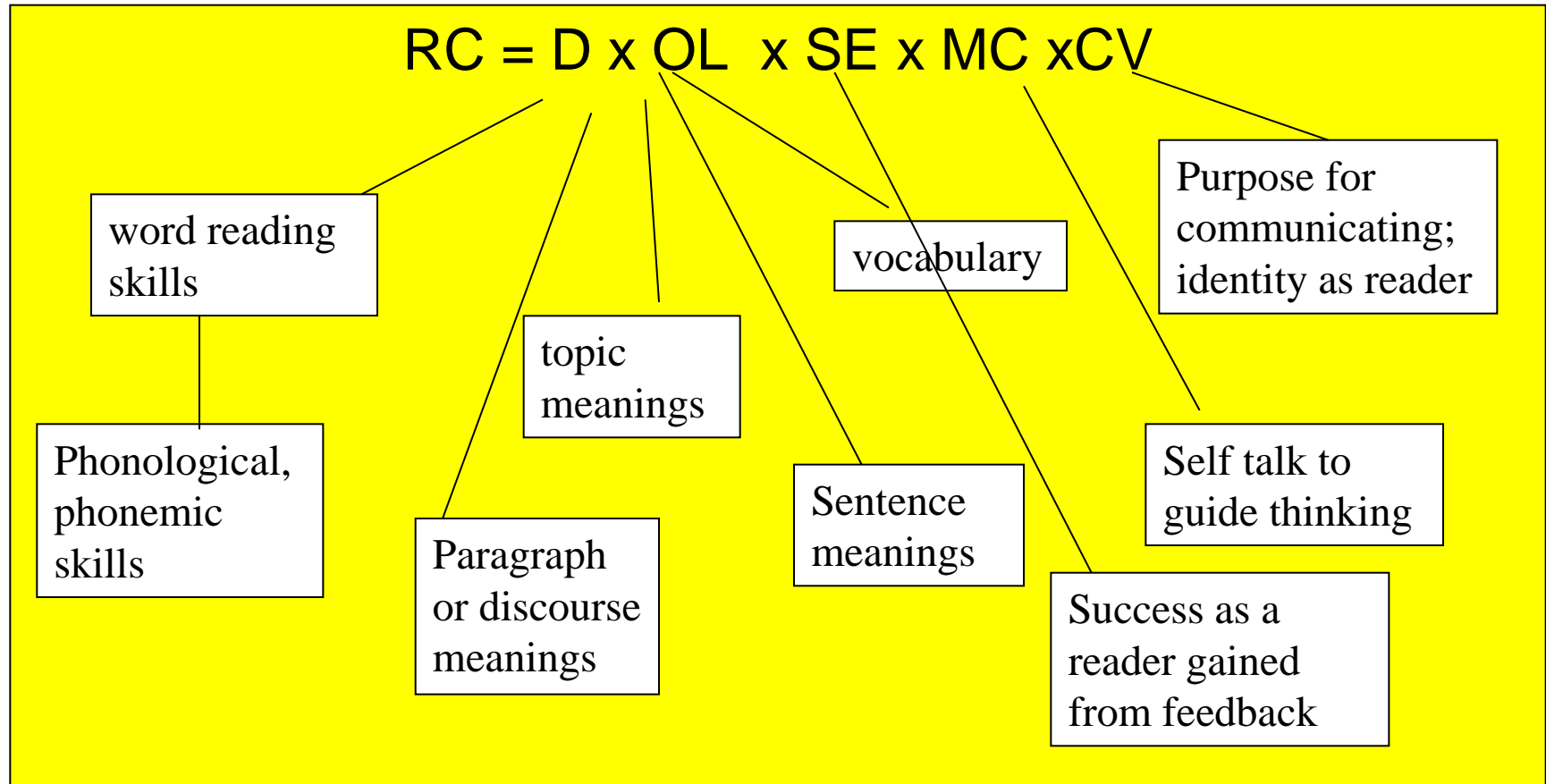
Self efficacy, identity as a reader

Metacognition as a reader, ability to manage reading activity

Cultural valuing of reading as a skill, its use beyond school

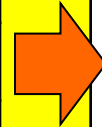
Our literacy learning profile needed to target these aspects

# Modified simple view of reading elaborated by text processing theories



# Identifying the reading profiles using Neale

YOS	accuracy	comprehension	rate
2	<15	<6	<22
3	<33	<11	<37
4	<41	<15	<51
5	<47	<18	<57
6	<57	<21	<65



Those who underachieved

1. in all domains of reading
2. in accuracy + comprehension
3. in accuracy +rate
4. in comprehension +rate
5. in accuracy only
6. in comprehension only
7. in rate only
8. in none of the domains; they scored above the 25<sup>th</sup> % in all domains.

# The three intervention pathways

## ERIK

### *Phonological awareness pathway.*

Each session teaches a spoken onset and/or rime unit through various phonological and phonemic skills (rhyming, blending and segmenting) and using these to read and spell words and to read prose.

### *Orthographic processing pathway.*

Each session teaches a letter cluster, either a written rime or a written onset for one syllable words.

It teaches word reading skills (segmenting and blending to read written words) and using these in reading and writing activities.

### *Oral language pathway.*

Each session teaches a comprehending strategy first in oral language contexts and then applied to reading.

The teaching sequence:

- inferring the topic of the text and questions it might answer;
- visualizing sentences and paraphrasing sentences.

# The structure of each session

Each session comprised the following types of learning activities: students

- recall what they learnt from earlier session by re-reading text from the previous session.
- learn pathway- specific skills (rhyming, sound blending and spoken word segmenting skills in the phonological pathway, segmenting and blending written words using phonic strategies in the orthographic pathway and application of comprehension strategies in the comprehension pathway).
- read and write target words.
- read relevant prose.
- review explicitly what has been learnt in the session.

Every fifth session : review session.

Re-administer prose and isolated word reading tasks, word reading skills for text similar to those used on intervention teaching and build students' reading self-efficacy.

# The criteria used to allocate to an intervention

## Year 1 (post RR) and Year 2

Below 16<sup>th</sup> %ile in accuracy & comprehension or below 25<sup>th</sup> %ile in accuracy & low in the phonological tasks

***Phonological pathway.***

15-25<sup>th</sup> %ile accuracy and low in both phonological and orthographic tasks (if not an ESL student)

***Orthographic pathway.***

Below 25<sup>th</sup> %ile accuracy & low in orthographic tasks or below 25<sup>th</sup> %ile in comprehension

***Oral language pathway.***

## Year 1 (post RR) and Year 2

Below 15<sup>th</sup> %ile in accuracy and low on the phonological tasks or an ESL student or below 15<sup>th</sup> %ile in both accuracy and comprehension

***Phonological pathway.***

Slow processing speed, decoding and reading rate, poor RAN & average scores on phonological tasks or below the 15<sup>th</sup> %ile in accuracy and low orthographic score

***Orthographic pathway.***

Below 15<sup>th</sup> %ile in comprehension but not in accuracy

***Oral language pathway.***



# The number of students comprising each profile in each intervention at each year level

	Phonological	Orthographic	Language	Phonological + orthographic	Orthographic + language
<i>Second year of schooling</i>					
under on all measures	24	4		6	
under on accuracy + comprehension	17	13	3	2	
under on accuracy + rate	6				
under on accuracy	3				
under on comprehension + rate	1			1	
under on comprehension	1	2	10		
under on rate	1	4	2	3	
above on all	11	7	19	4	
Total	64	30	34	16	

# The number of students comprising each profile in each intervention at each year level

	Phonological	Orthographic	Language	Phonological + orthographic	Orthographic + language
<i>Third year of schooling</i>					
under on all measures	100	45	35	13	5
under on accuracy + comprehension	29	25	26	4	1
under on accuracy + rate	6	10	3		
under on accuracy	3	7	4		
under on comprehension + rate	2		6		
under on comprehension	1		15	1	
under on rate	2	4	5		
above on all	1	4	11		1
Total	144	95	105	18	7

# The number of students comprising each profile in each intervention at each year level

	Phonological	Orthographic	Language	Phonological + orthographic	Orthographic + language
<i>Fourth year of schooling</i>					
under on all measures	47	51	37	10	4
under on accuracy + comprehension	3	19	20		3
under on accuracy + rate	5	4	9	1	
under on accuracy	4	6	1	1	
under on comprehension + rate			8		
under on comprehension		2	13		
under on rate		2	3		
above on all	4	4	3	1	
Total	63	88	94	13	7

# The number of students comprising each profile in each intervention at each year level

	Phonological	Orthographic	Language	Phonological + orthographic	Orthographic + language
<i>Fifth year of schooling</i>					
under on all measures	12	22	9		5
under on accuracy + comprehension	10	12	5		4
under on accuracy + rate	2	3	3		2
under on accuracy	1	1	2		2
under on comprehension + rate			2		1
under on comprehension	1		3		1
under on rate		2	1		
above on all		1	4		
Total	26	41	29		15

# The number of students comprising each profile in each intervention at each year level

	Phonological	Orthographic	Language	Phonological + orthographic	Orthographic + language
<i>Fifth year of schooling</i>					
under on all measures	3	5	3		
under on accuracy + comprehension		1	2		
under on accuracy + rate					
under on accuracy					
under on comprehension + rate		1	1		
under on comprehension	1	1	1		
under on rate					
above on all					
Total	4	8	7		

Earlier years, a greater portion in phonological intervention



Later years, a greater portion in orthographic and language interventions

# Assessment of literacy learning profile

A literacy learning profile was compiled for each student. This comprised their performance in a number of areas necessary for successful early literacy learning;

- phonological and phonemic skills and phonological short term memory,
- ability to make verbal analogies,
- ability to learn an orthographic code and to display visual symbolic and orthographic processing,
- ability to match spoken and written words and to use read pseudo words,
- their listening comprehension and
- their RAN of letters and digits.


# The design of the evaluation

## The centrality of the reading profile in this evaluation

A student's reading performance and their capacity to learn more about reading is assumed to be a synthesis of their knowledge and skill in the three domains of reading.

The efficacy of ERIK is investigated in terms of these profiles.

Correlation (Pearson, 2-tailed) coefficients between Neale Accuracy, Comprehension and Rate raw scores pre intervention

	Comprehension			Rate		
	All n=1072	profile 1 n=442	profile 8 n=75	All n=1018	profile 1 n=442	profile 8 n=75
Accuracy	.58**	.77**	.46**	.56**	.67**	.65**
Comprehension				.28**	.55**	.29*

# The design of the evaluation

## The centrality of the Simple View of Reading

The Simple View of Reading was used to underpin the intervention pathways. Are data aligned with this ?

$$RC = D \times OL$$

In our data : Neale comp score pre teach = Neale accur raw score pre teaching x s verbal analogies ?

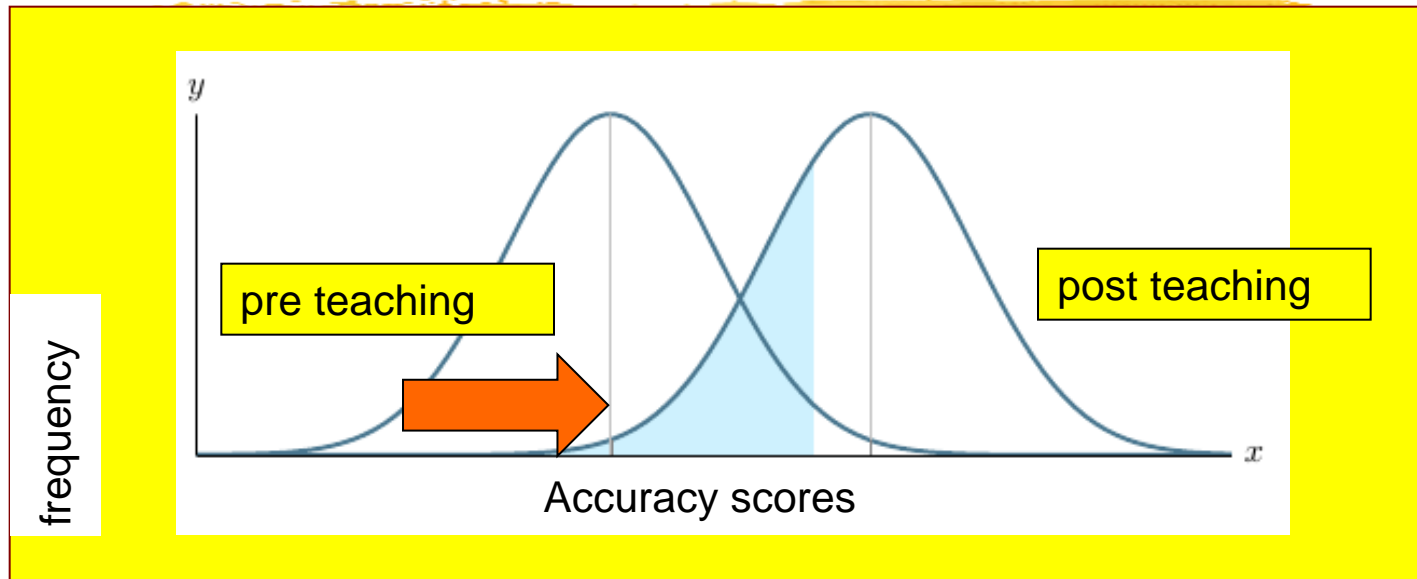
The correlations between reading comprehension and product of these two skills for each profile

in all domains of reading	0.42**	n = 377
in accuracy + comprehension	0.44**	n =174
in accuracy +rate	0.50**	n = 39
in comprehension +rate	0.24	n =32
in accuracy only	0.47	n =17
in comprehension only	0.52**	n =33
in rate only	0.36	n = 19
in none of the domains	0.37*	n =44

The student data are consistent with the main causes of underachievement in reading comprehension predicted by SVR. SVR accounted for 20 - 25 % of variance in reading comprehension for the profiles covering 91 % of the cohort.



# To investigate whether the interventions worked



...the number of lessons per week a student had ?

...the student's reading profile ?

Was there improvement?

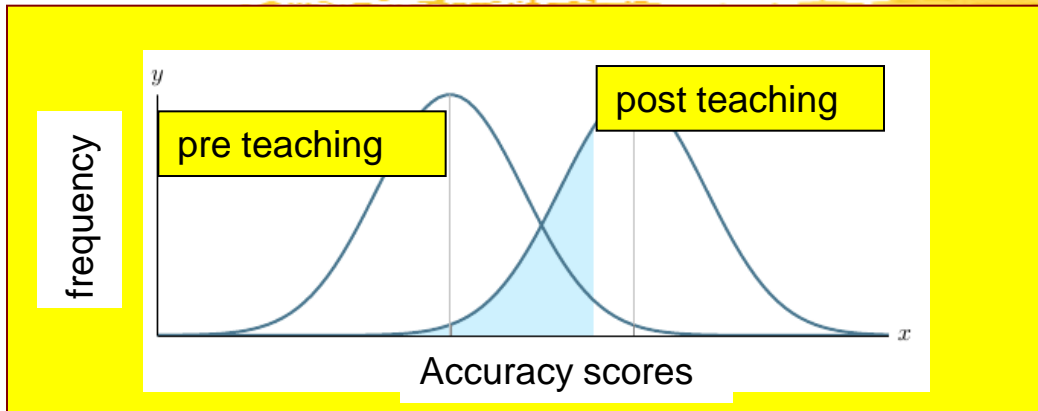
Was the extent of improvement affected by

...the intervention pathway a student was allocated to ?

...number of years of schooling

...the total number of lessons a student had ?

# To investigate whether the interventions worked



The main and interaction effects for the entire cohort

To compare the efficacy of the three interventions : oneway ANOVA, ANCOVA with pre-intervention reading comprehension score the covariate and comparison of gains at each year level.

To compare improvement for each learning profile in each intervention at each year level : ANOVA, analysis of gain scores and effect sizes (Cohen's d) and comparison with mean gain.

To compare total number of lessons and the lesson frequency per week for each intervention at each year level : ANOVA

To identify the aspects of literacy learning profile are associated with reading gain: use linear regression.

The evaluation uses a general linear modeling repeated measures ANOVA design.

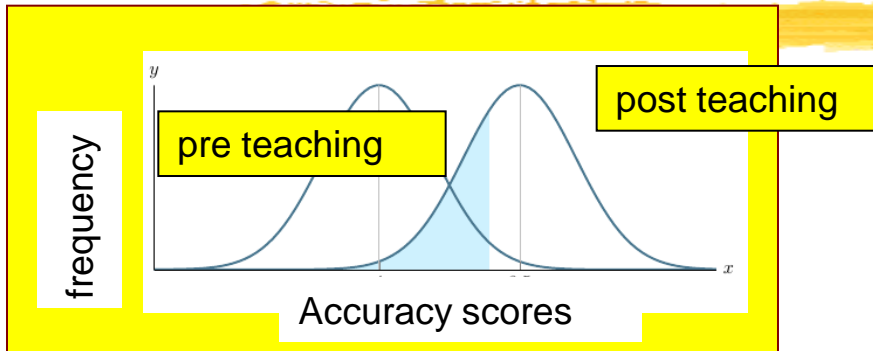
The comparison of pre- and post reading raw score was the within subjects factor.

The between subject effects

- reading profiles (8)
- intervention pathways (3),
- number of years of schooling (5),
- Delivery aspects ( total number of lessons and the number of lessons per week).

Only 9 students had complete sets of data. The number of lessons per week omitted from some analysis.

# Three comments re the design



Cohen's <i>d</i>	Cohen's post above (%)	proportion (%) of the groups that overlap	probability of higher post teaching score
.2	58	92	56
.3	62	88	58
.4	66	84	61
.5	69	80	64
.6	73	76	66
.7	76	73	69
.8	79	69	71
1.0	84	62	76
1.2	89	55	80
1.4	92	48	84
1.5	95	42	87
2.0	96	37	90
2.5	98	32	92
3.0	99.9	13	98

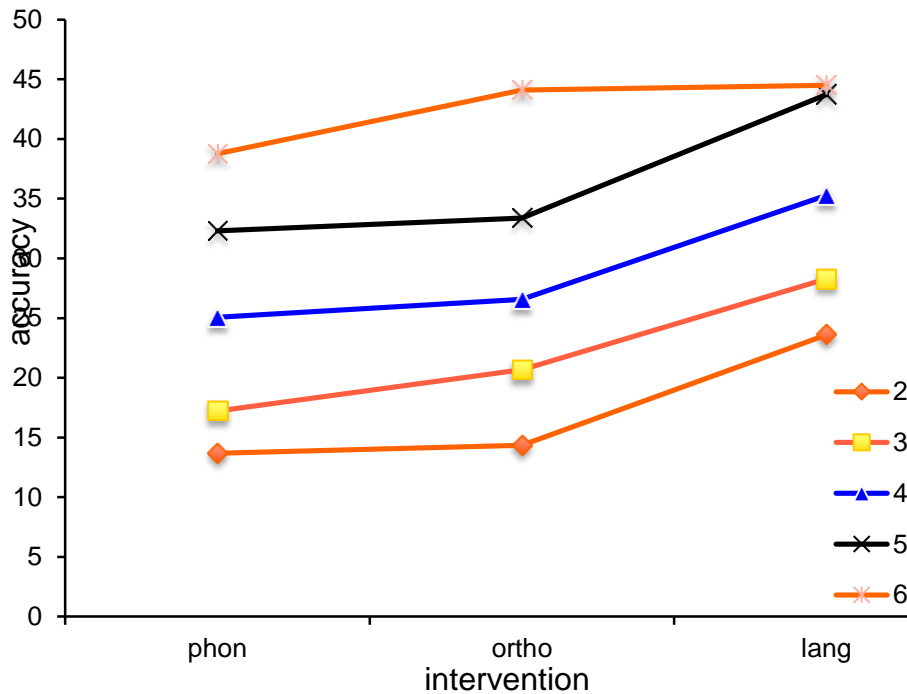
How to compare pre- and post intervention outcomes ? Gain scores or use of repeated measures analysis of variance ?

How to calculate and interpret Cohen's *d* effect size to compare post and pre-intervention means ? Cohen recommended against blanket interpretation ( "canned effect sizes". Interpret using additional statistics

Some of the reading profile cohorts of reading profiles at some of the year levels had very few students. This limited the statistical procedures that could be used. Where  $n < 10$ , use t-tests only.

# Pre teaching differences in accuracy for each intervention

Preteaching reading accuracy scores

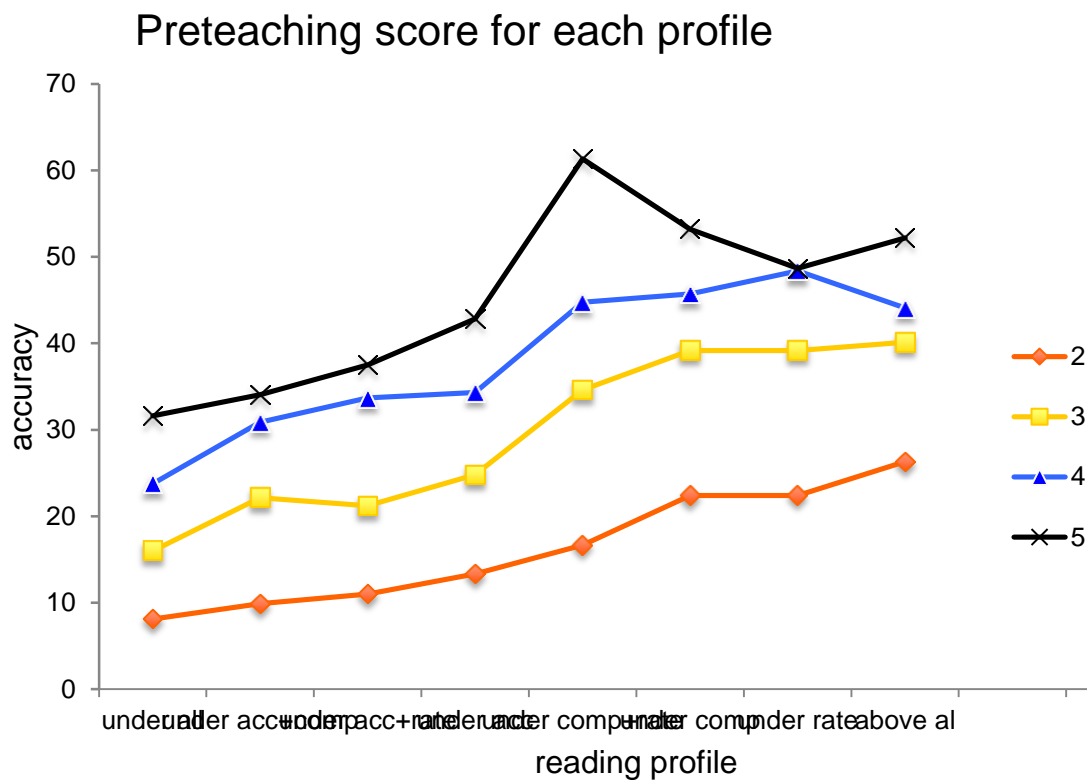


lang higher than phon or orth

## Literacy learning profiles

- Year 3 lang had higher letter sound decoding and orthographic processing scores than phon.
- Year 3 orth had higher verbal analogies scores than phon.
- Year 5 orth had higher RAN for letters and names than phon

# Pre teaching differences in accuracy for each intervention



Lowest for the profiles in which students underachieved on all measures of reading or in comprehension and accuracy.

Highest for the cohorts in which students underachieved only in rate and in which they didn't underachieve on any measures.

This difference was significant for all interventions from years 2 to 5

Profiles 1 and 2 often lower than profiles 3-6.

These data support the use of the reading profiles as the unit of analysis in the evaluation of the efficacy of the intervention.

# Improvement in Neale accuracy raw scores

How did each of the main factors affect the improvement in reading accuracy for the student group as a whole ?

The teaching improved reading accuracy. This was influenced by the number of years of schooling and students' reading profiles.

The intervention pathways did not differ in their influence on the improvement regardless of the number of years of schooling . The rate of improvement did not differ across the interventions.

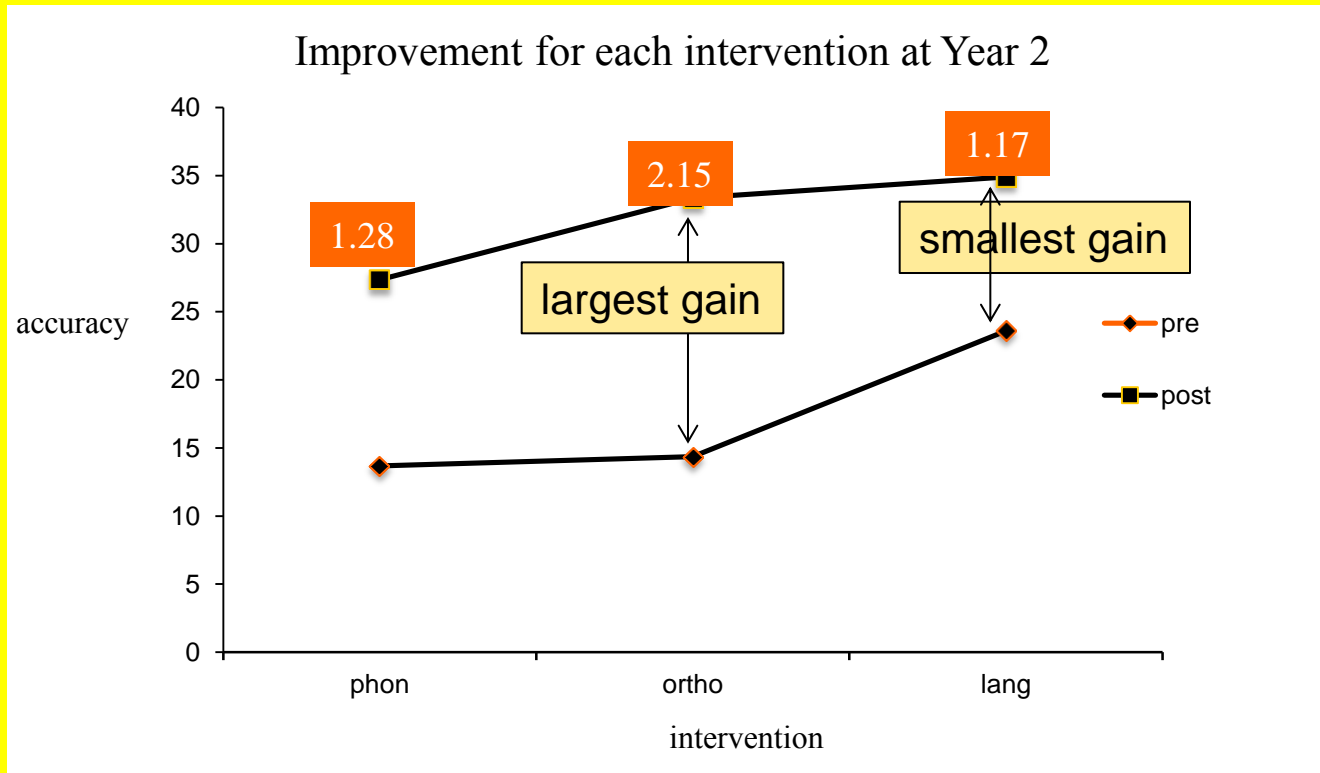
Students' reading profile influenced their level of improvement. The extent of improvement for different reading profiles was not influenced by the intervention pathway selected. This effect changed with years of schooling.

Neither the total number of lessons nor the number of lessons per week directly affected accuracy. The effect is complex. It depends on the intervention pathway selected and the reading profile.

Given the complex relationship between the variables, we need to examine their effect on accuracy separately, at each year level.

# Improvement in reading accuracy for students in the second year of school

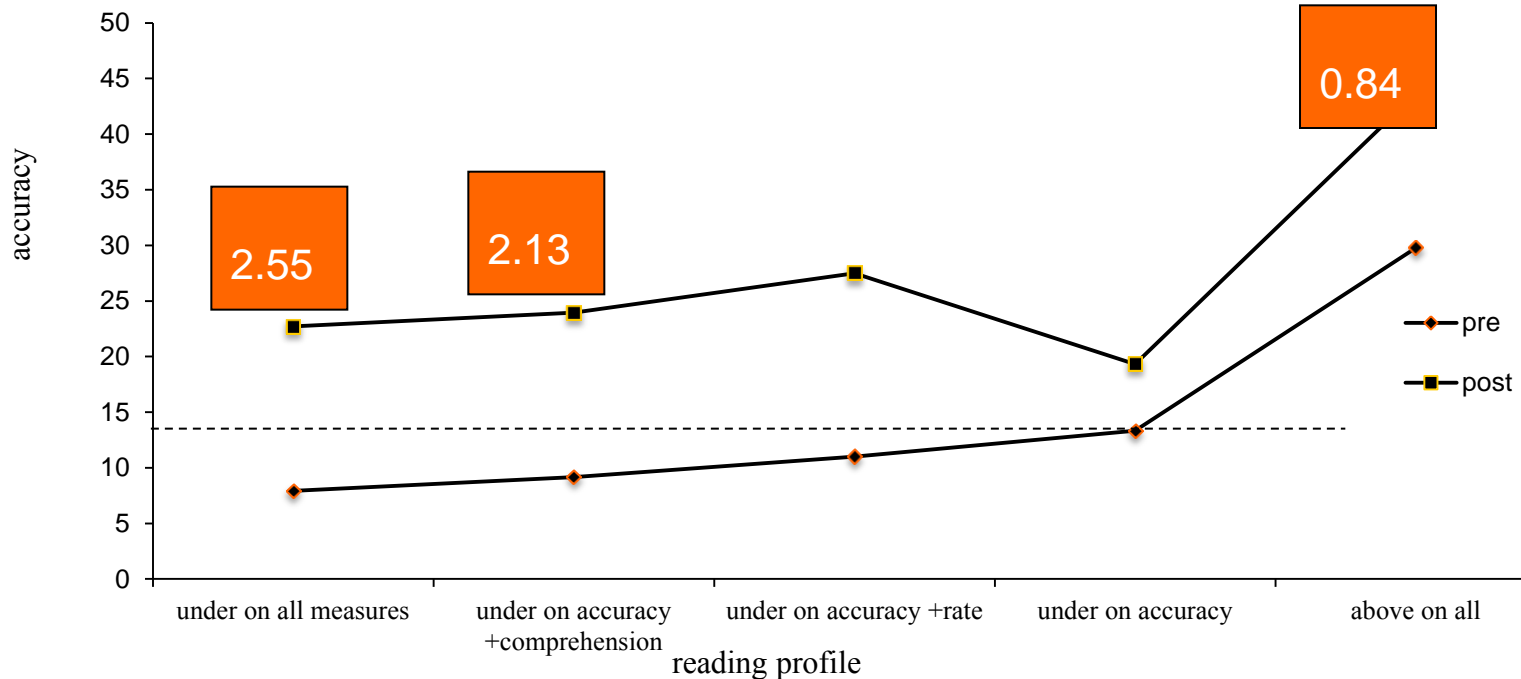
## Improvement for each intervention pathway



# Improvement in reading accuracy for students in the second year of school

Improvement for each reading profile in the phonological pathway

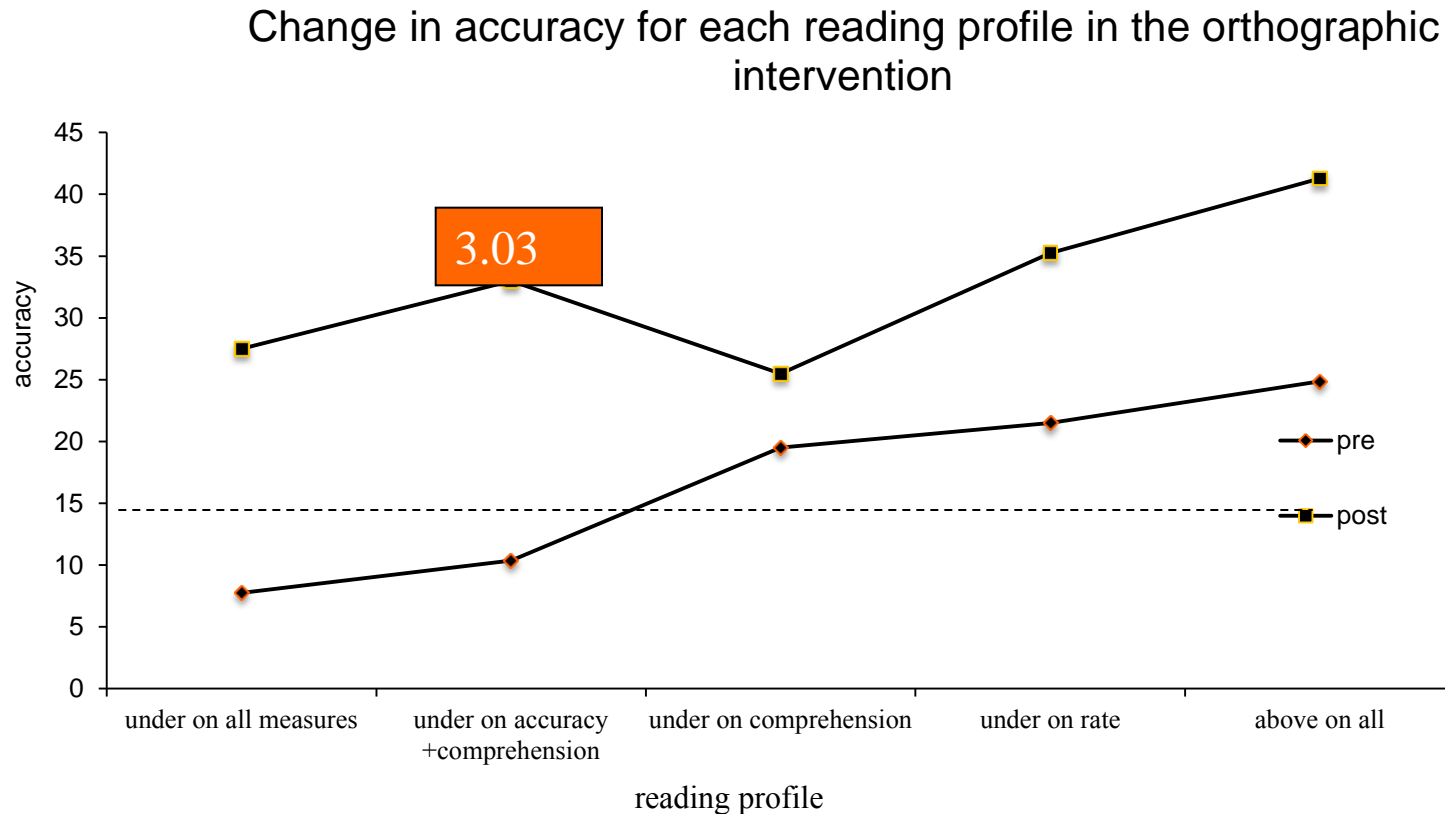
Change in accuracy for each reading profile in the phonological intervention





# Improvement in reading accuracy for students in the second year of school

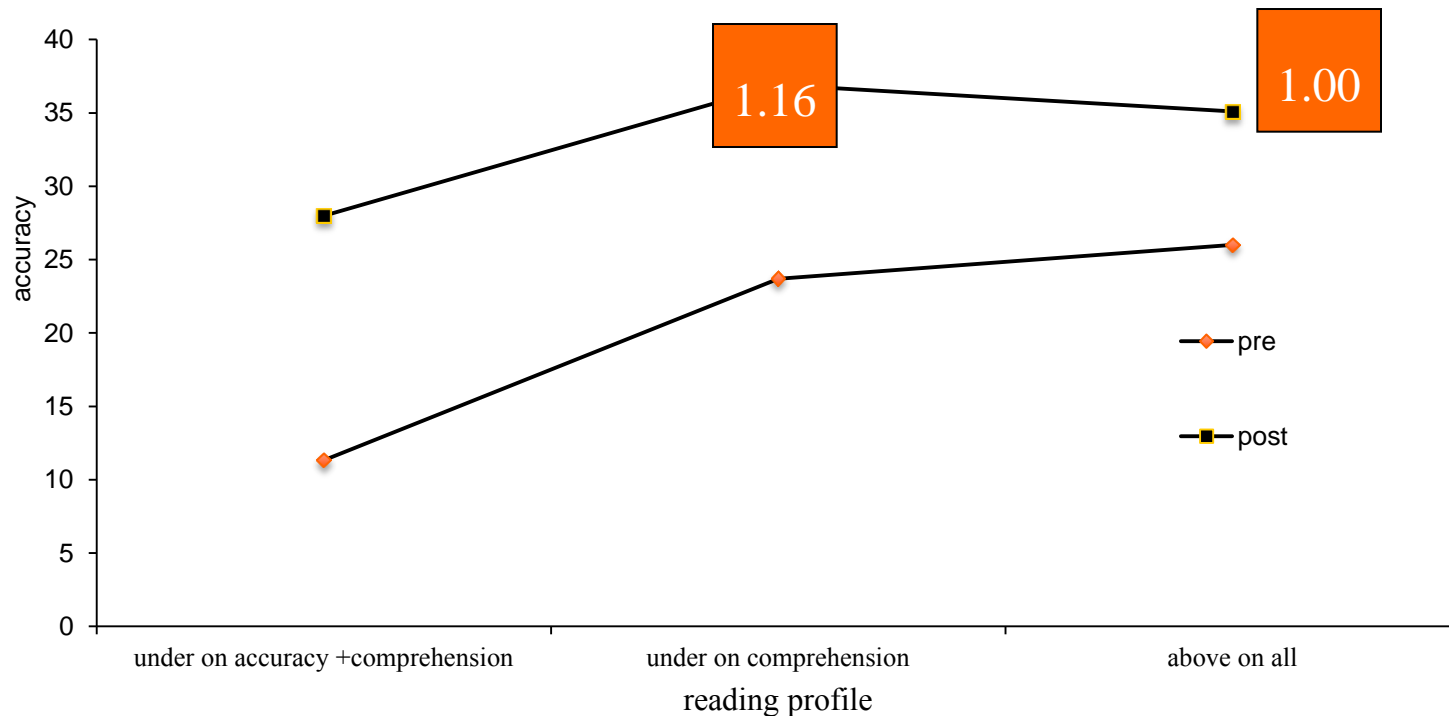
Improvement for each reading profile in the orthographic pathway



# Improvement in reading accuracy for students in the second year of school

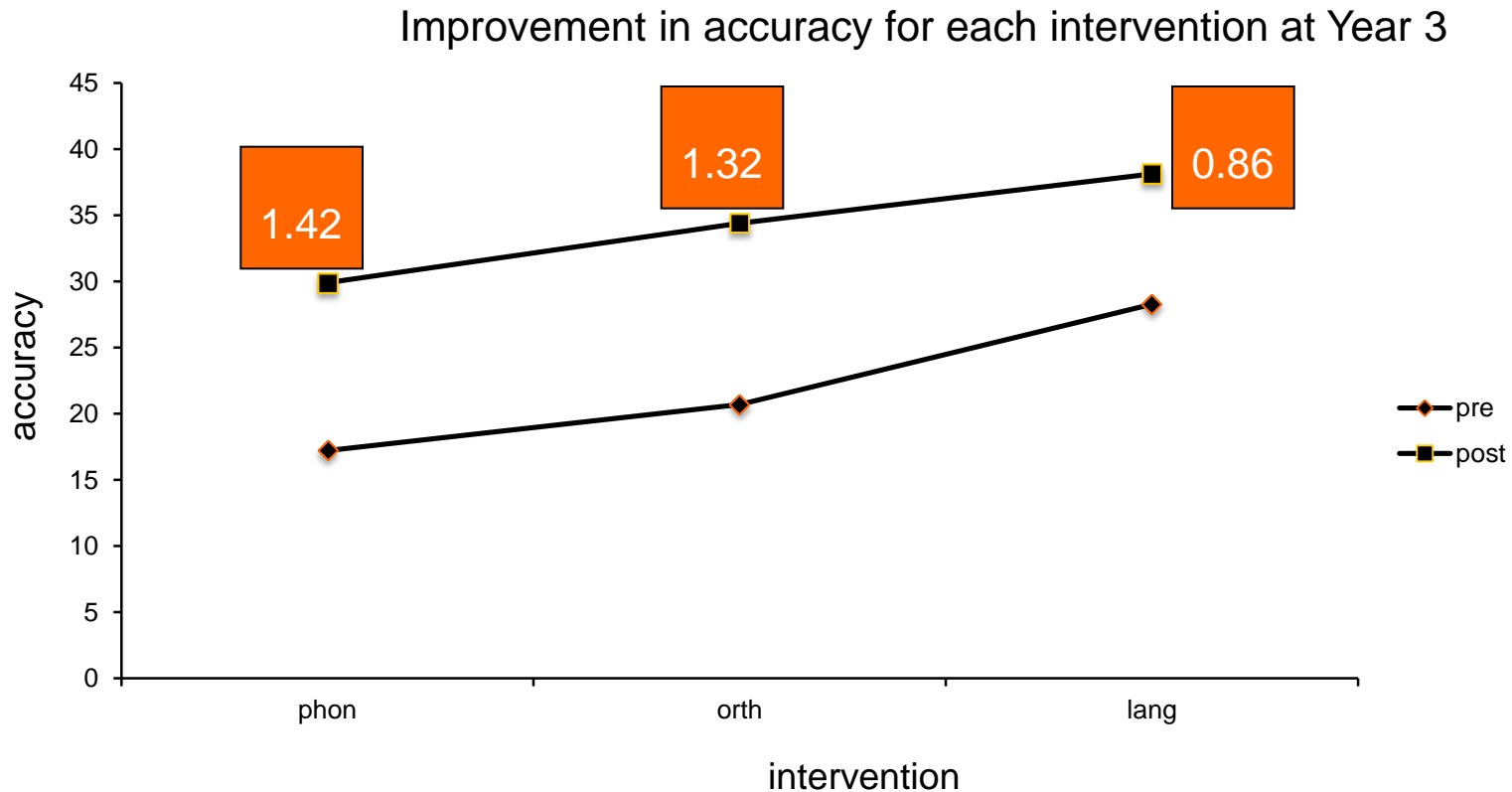
Improvement for each reading profile in the language pathway

Change in accuracy for each reading profile in the language intervention



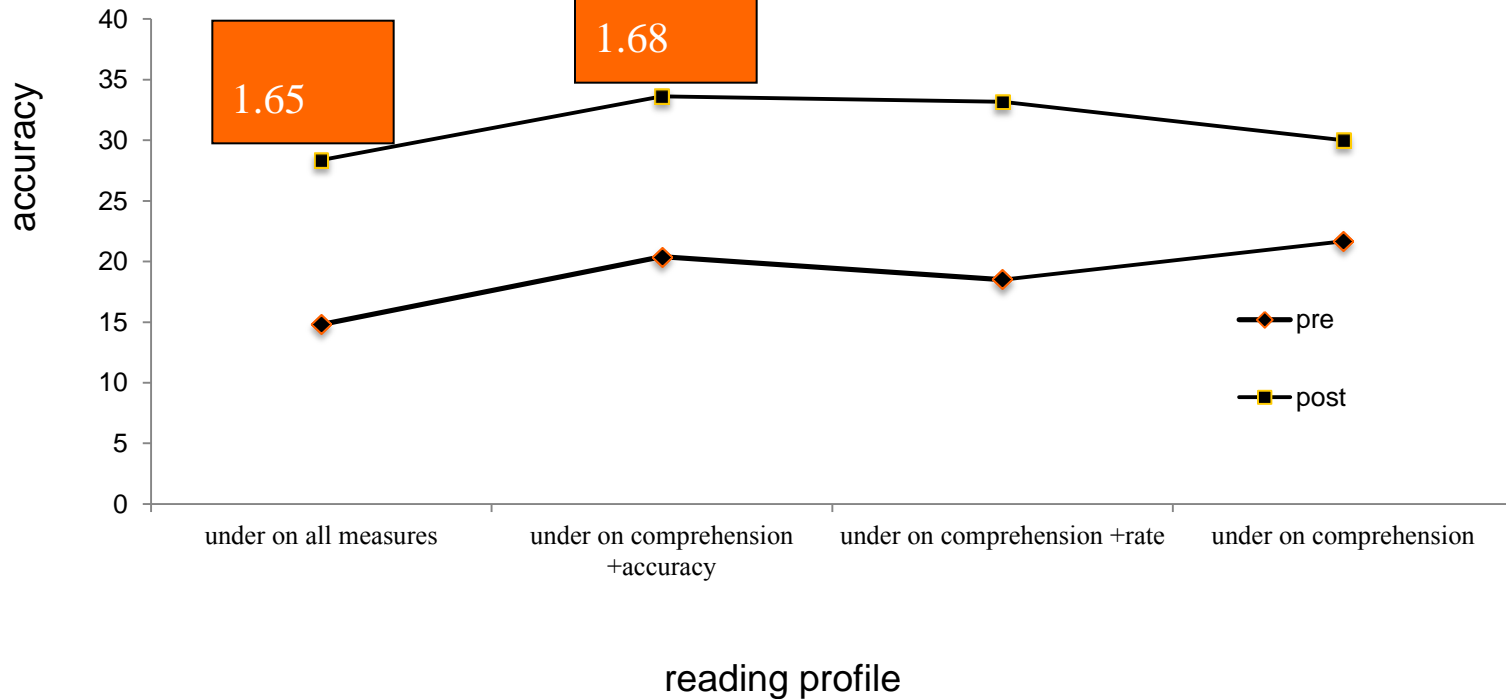
# Improvement in reading accuracy for students in the third year of school

Improvement for each intervention pathway



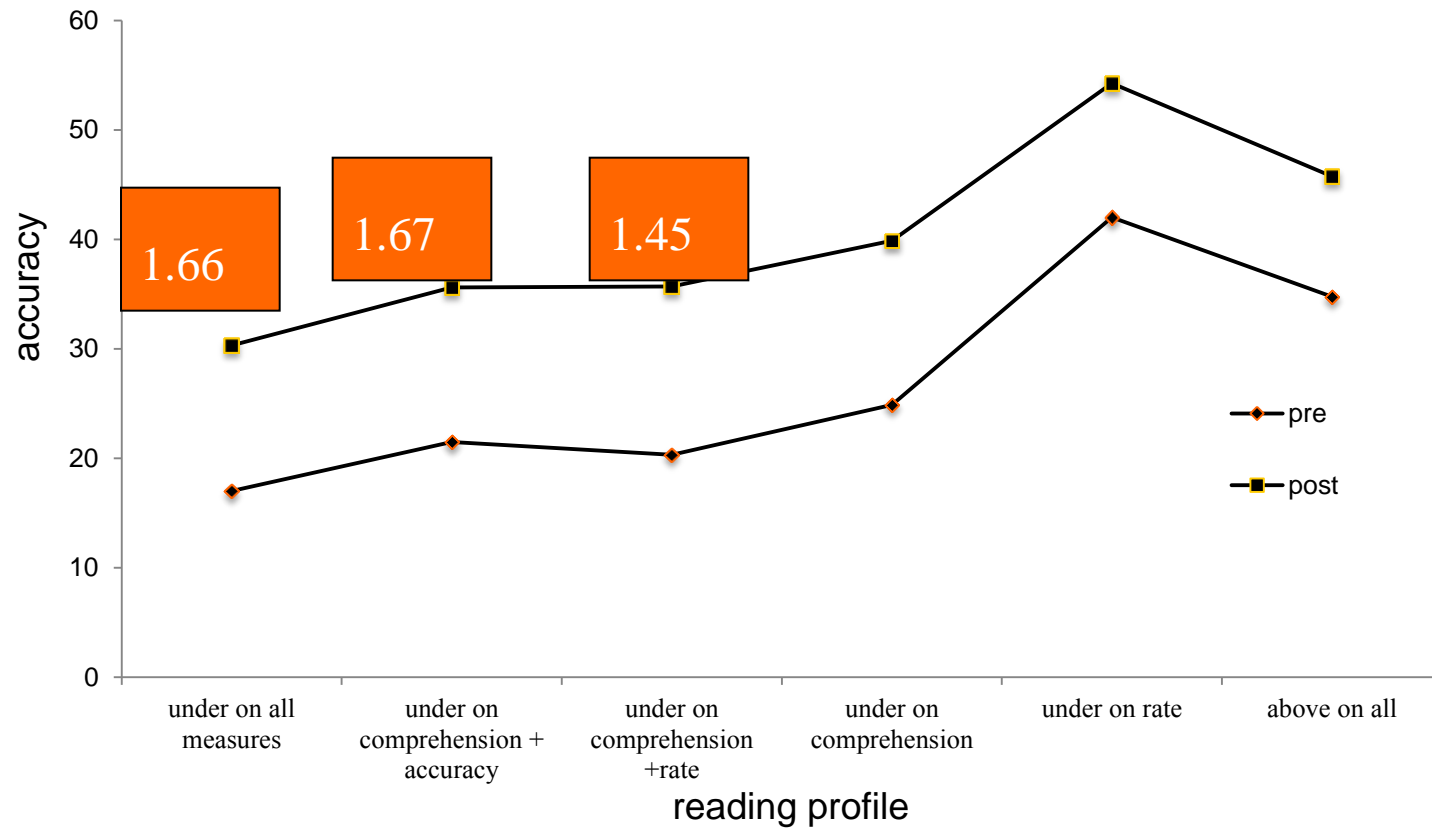
# Improvement in reading accuracy for students in the third year of school

Improvement for each reading profile in the phonological pathway



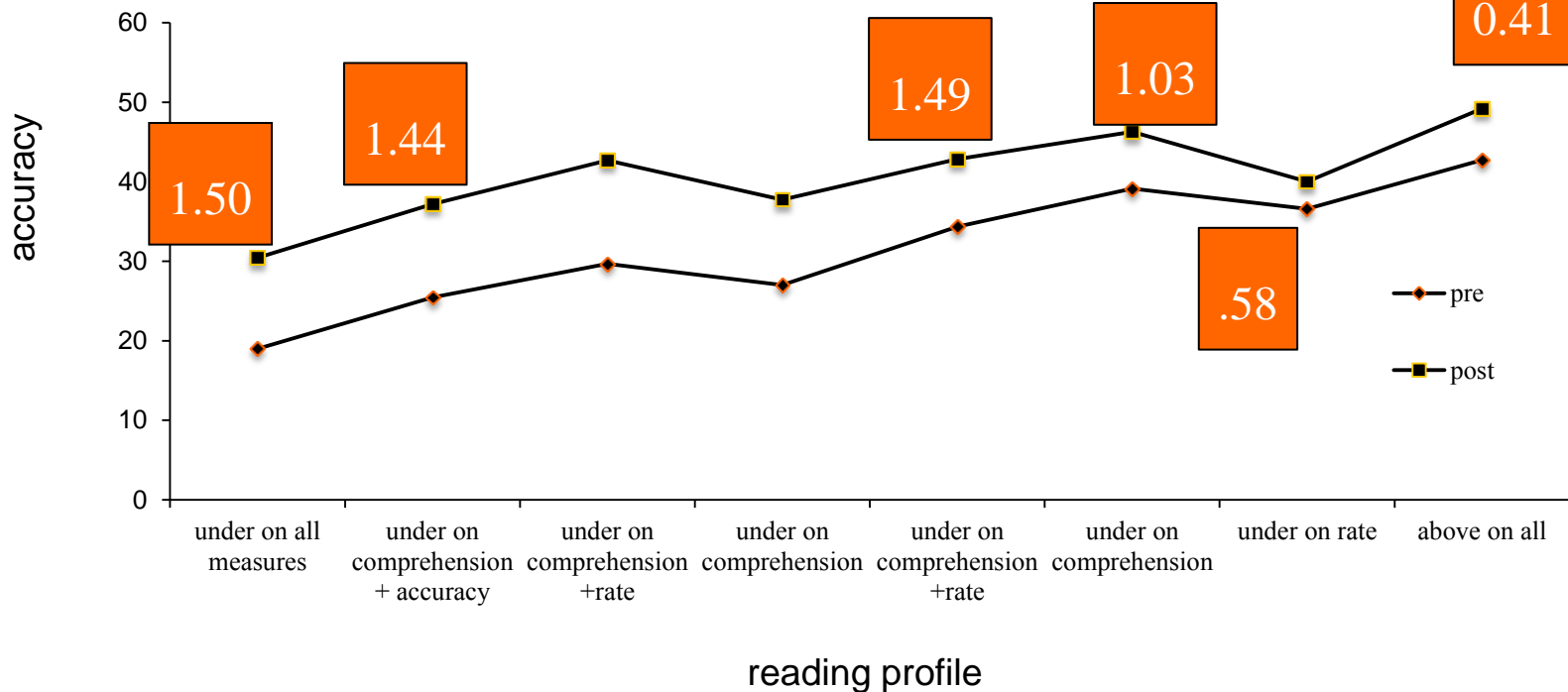
# Improvement in reading accuracy for students in the third year of school

Improvement for each reading profile in the orthographic pathway



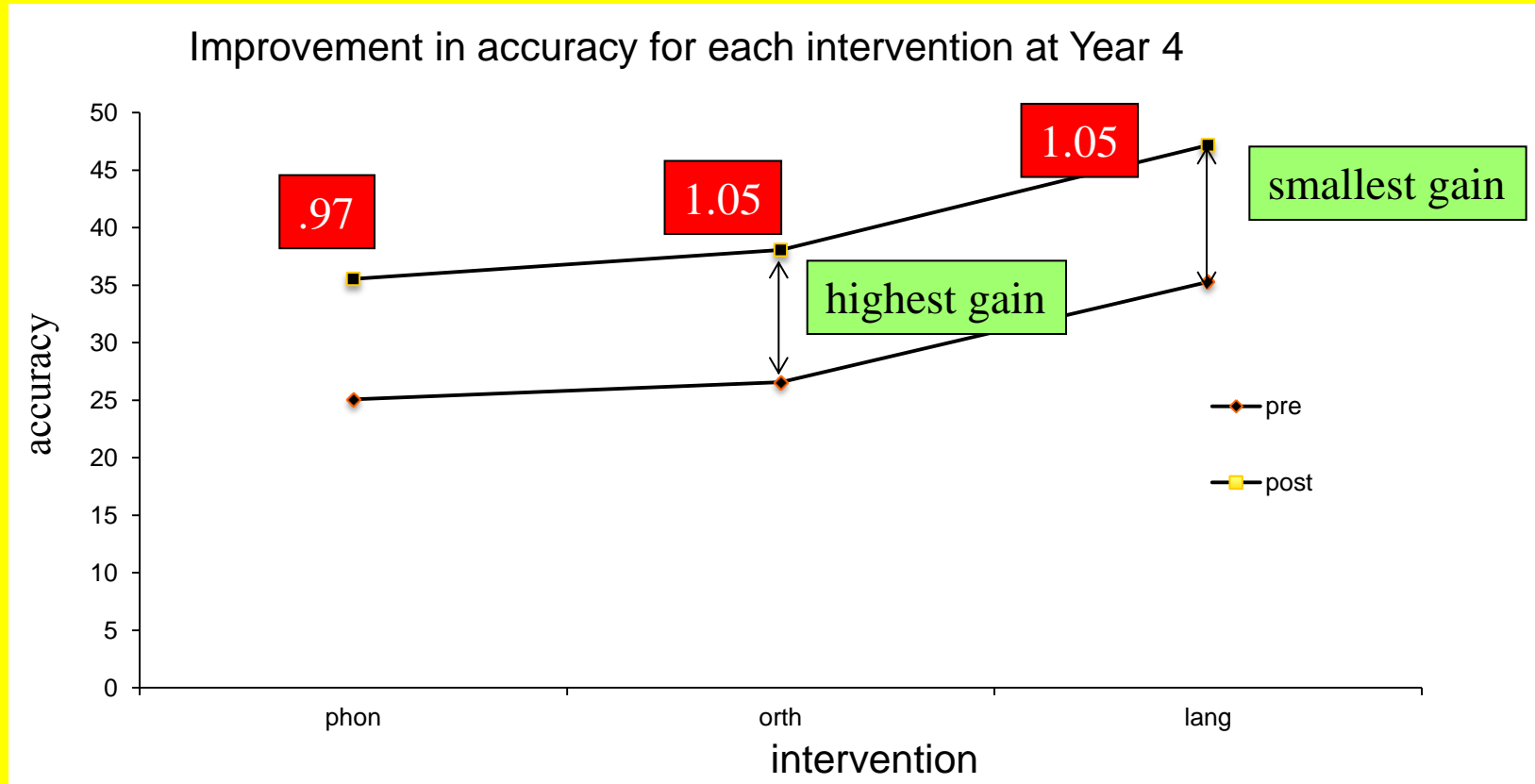
# Improvement in reading accuracy for students in the third year of school

Improvement for each reading profile in the oral language pathway



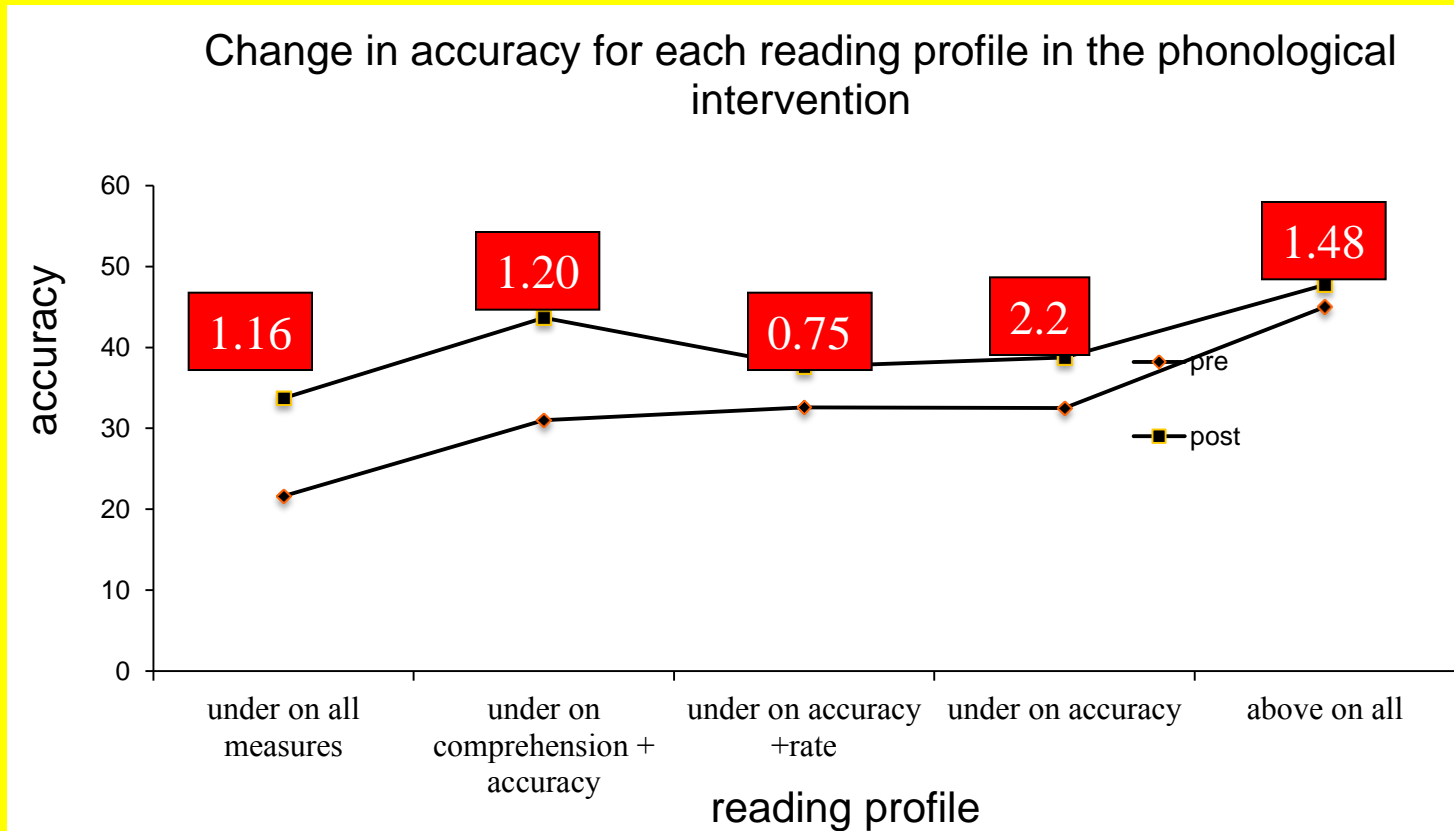
# Improvement in reading accuracy for students in the fourth year of school

Improvement for each intervention pathway



# Improvement in reading accuracy for students in the fourth year of school

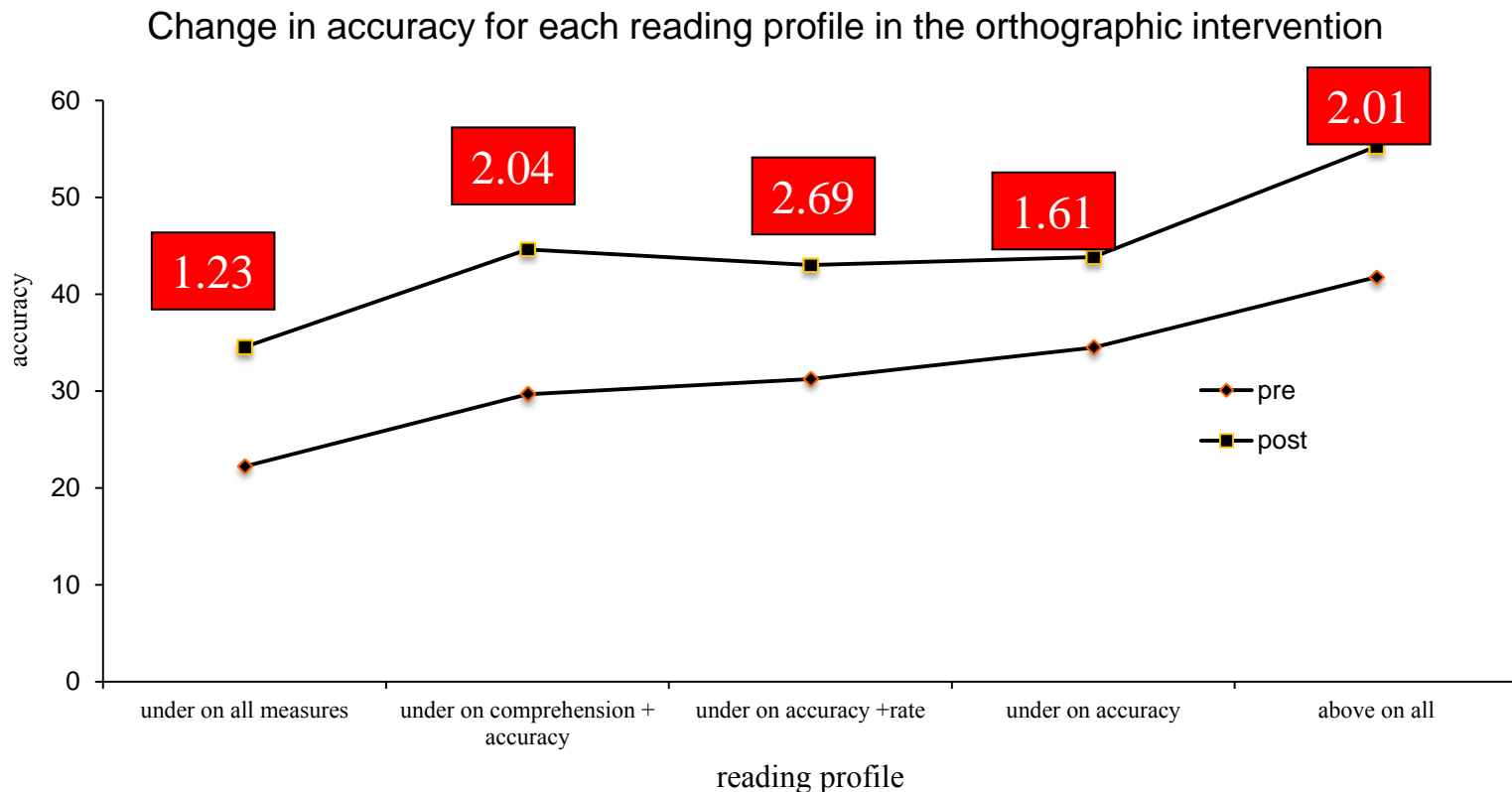
Improvement for each reading profile in the phonological pathway





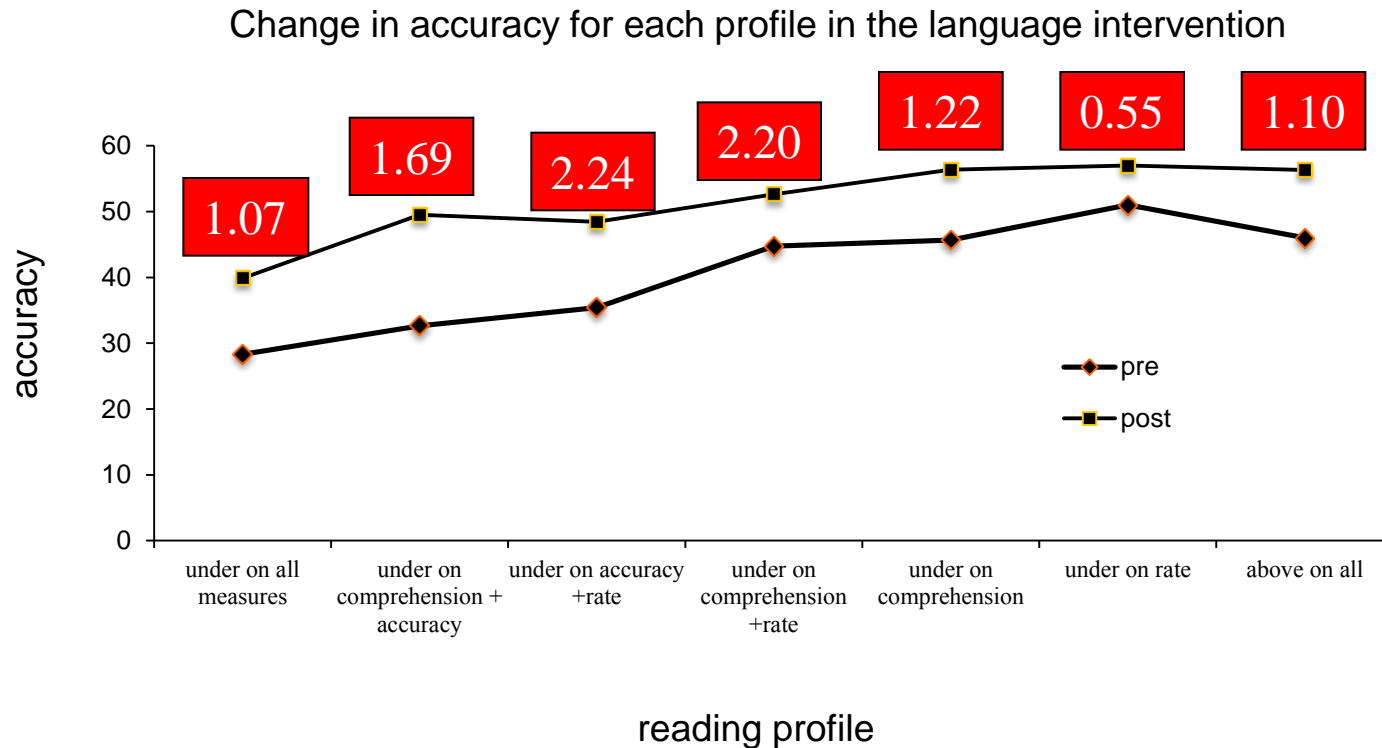
# Improvement in reading accuracy for students in the fourth year of school

Improvement for each reading profile in the orthographic pathway



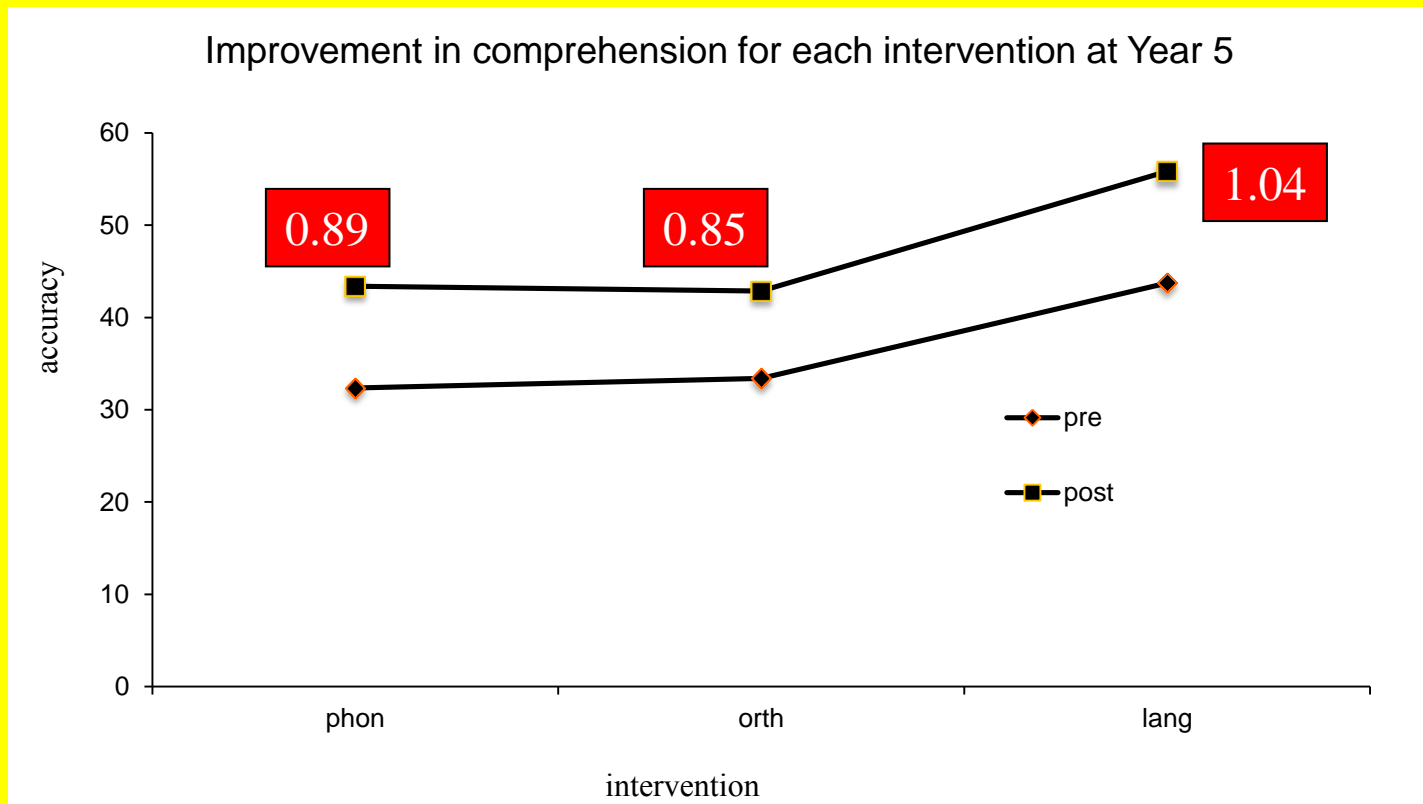
# Improvement in reading accuracy for students in the fourth year of school

Improvement for each reading profile in the language pathway



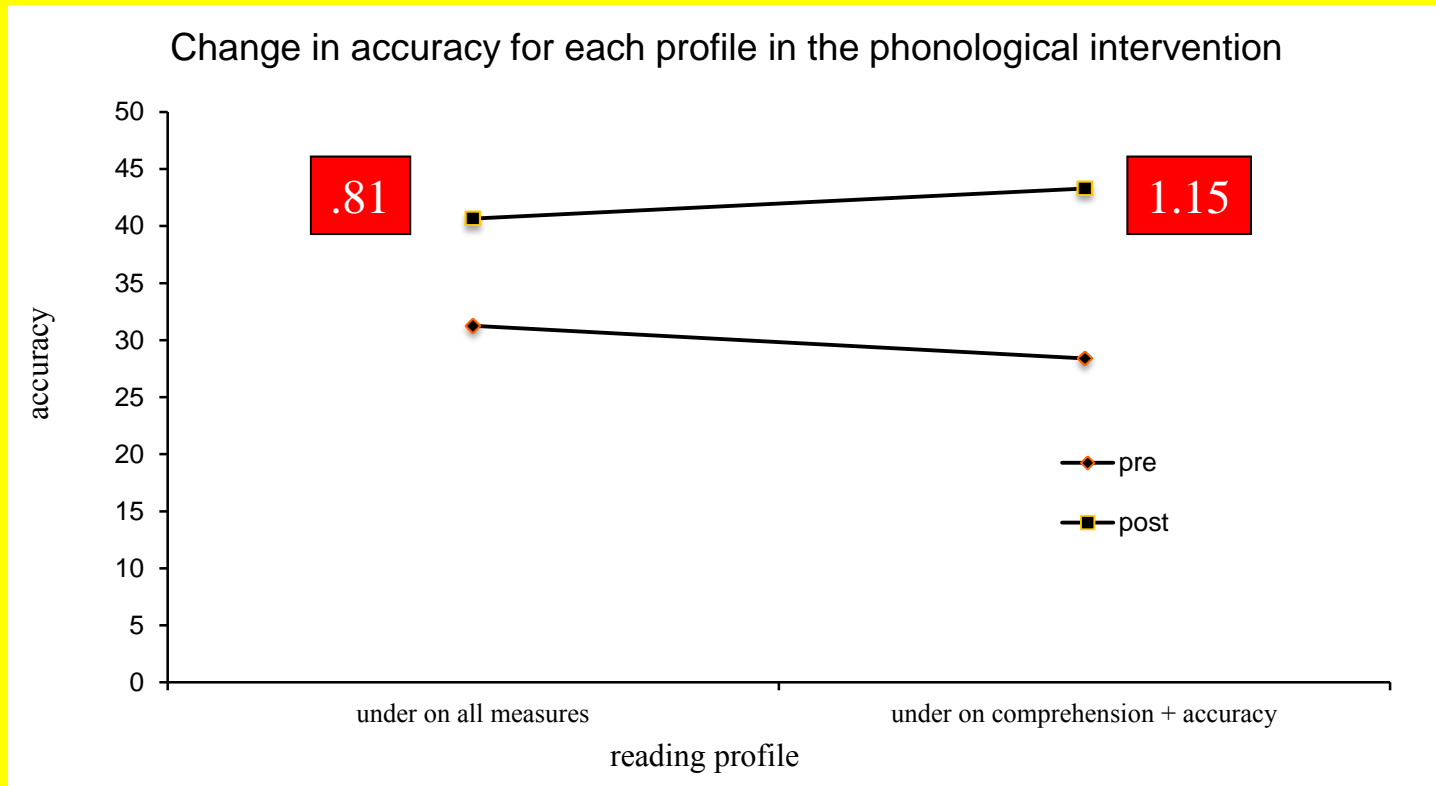
# Improvement in reading accuracy for students in the fifth year of school

Improvement for each intervention pathway



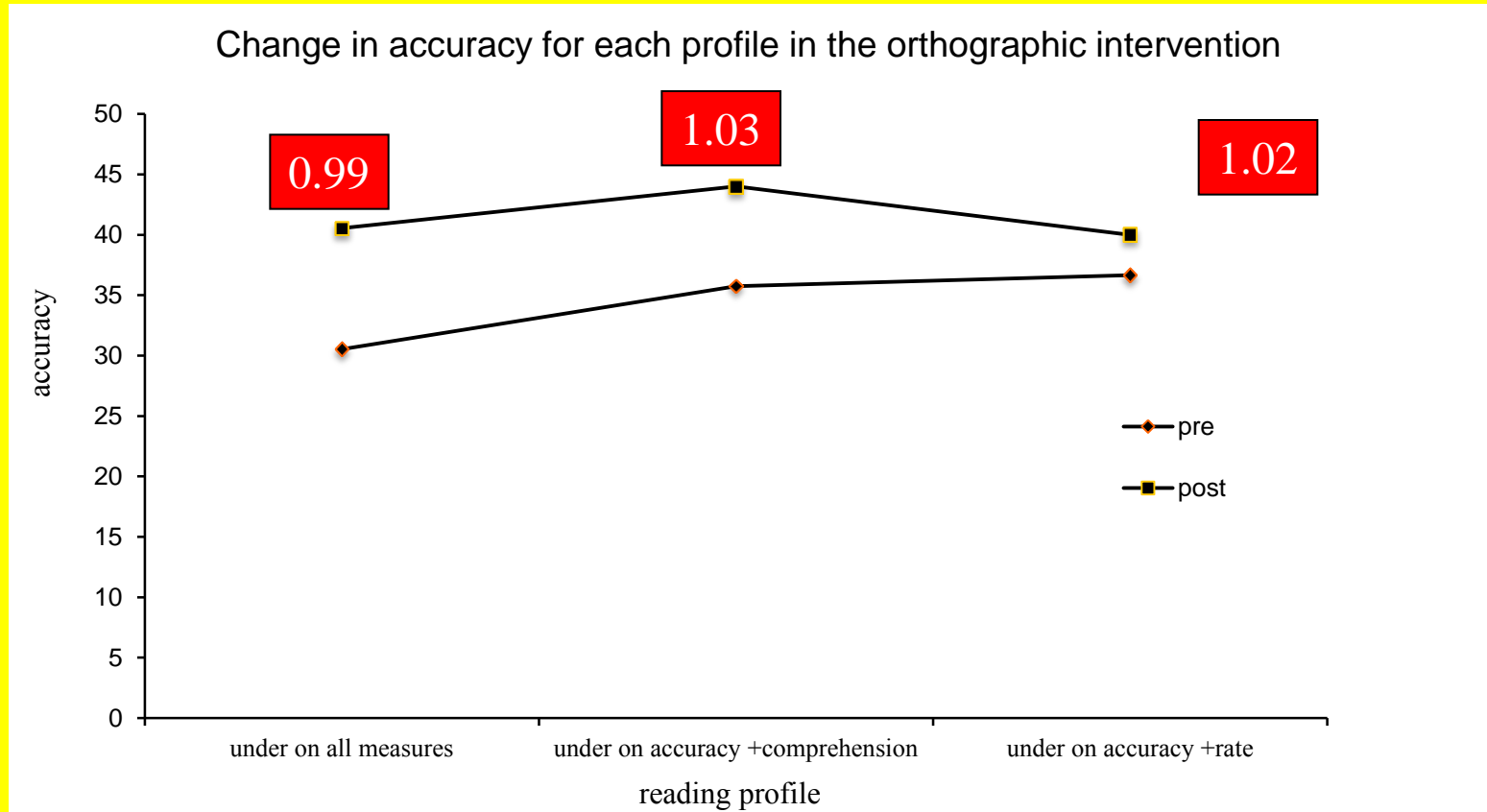
# Improvement in reading accuracy for students in the fifth year of school

Improvement for each reading profile in the phonological pathway



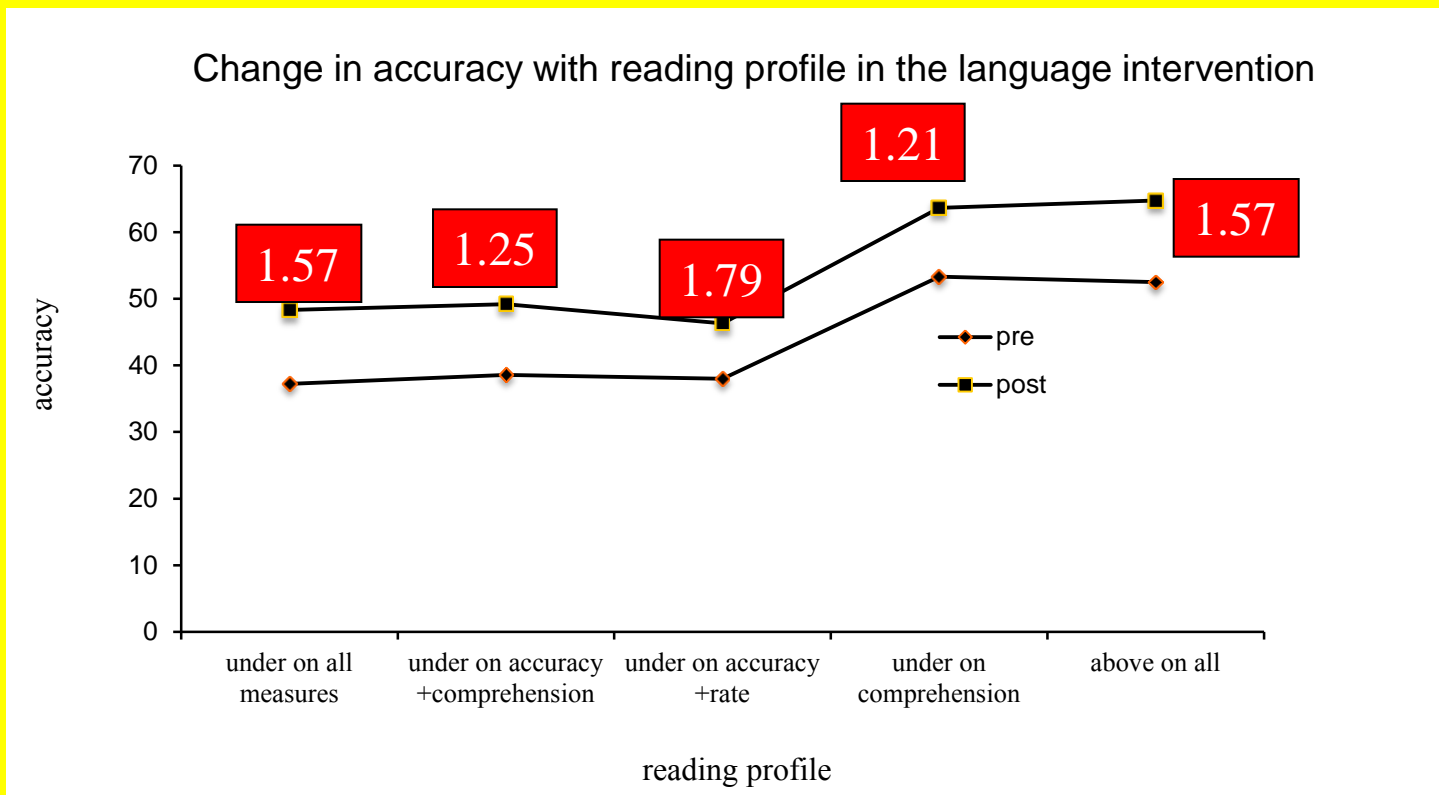
# Improvement in reading accuracy for students in the fifth year of school

Improvement for each reading profile in the orthographic pathway



# Improvement in reading accuracy for students in the fifth year of school

Improvement for each reading profile in the language pathway



# Summary of the effects of intervention and profile on improvement in reading accuracy

In terms of reading profile : all profile groups with n.10 students, (43 cohorts from two to five yos), showed improved reading accuracy with ES >1.00.

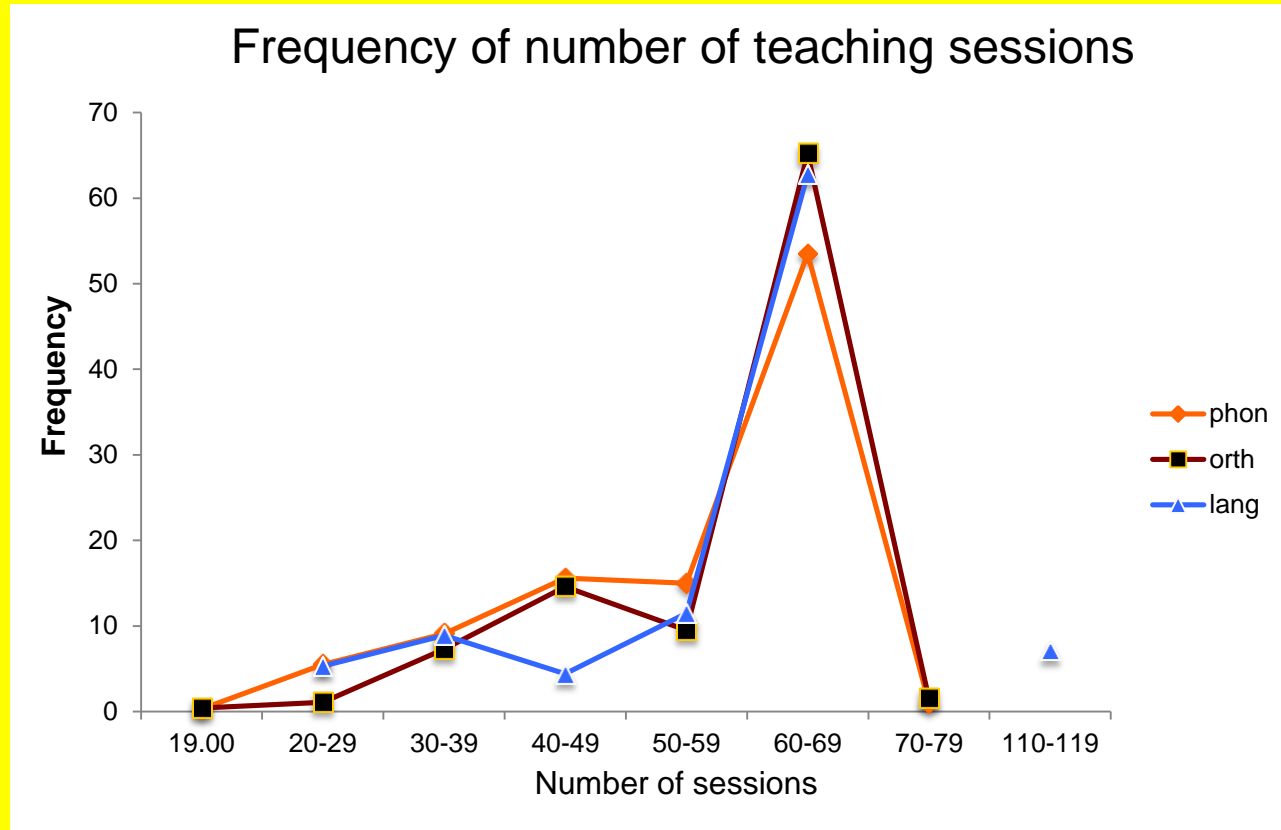
In terms of the efficacy of the three interventions: the orthographic intervention delivered the highest gains and the language context the lowest gains for students in their second to fourth years of school while the three interventions had similar outcomes for students in their fifth year.

The difference between the orthographic and oral language interventions is not surprising, given the teaching focus of both.

In terms of the combined effects of type of intervention and reading profile, for students 2<sup>nd</sup> to 4<sup>th</sup> yos, the profiles did not differ in their gains.

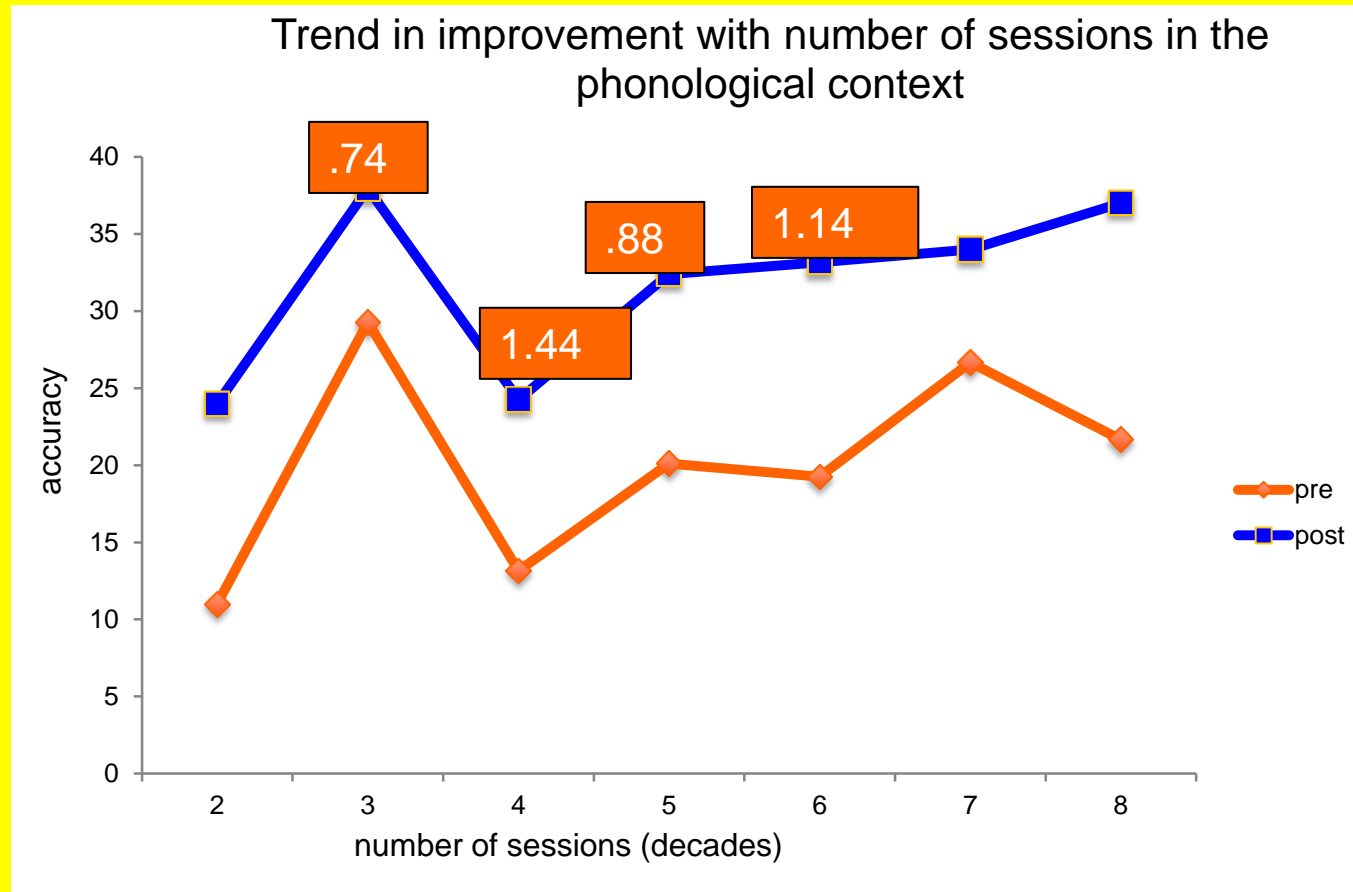
Given that some profiles had a lower entry accuracy score, this may warrant further examination.

# The influence of the number of lessons and weekly frequency on improvement in accuracy

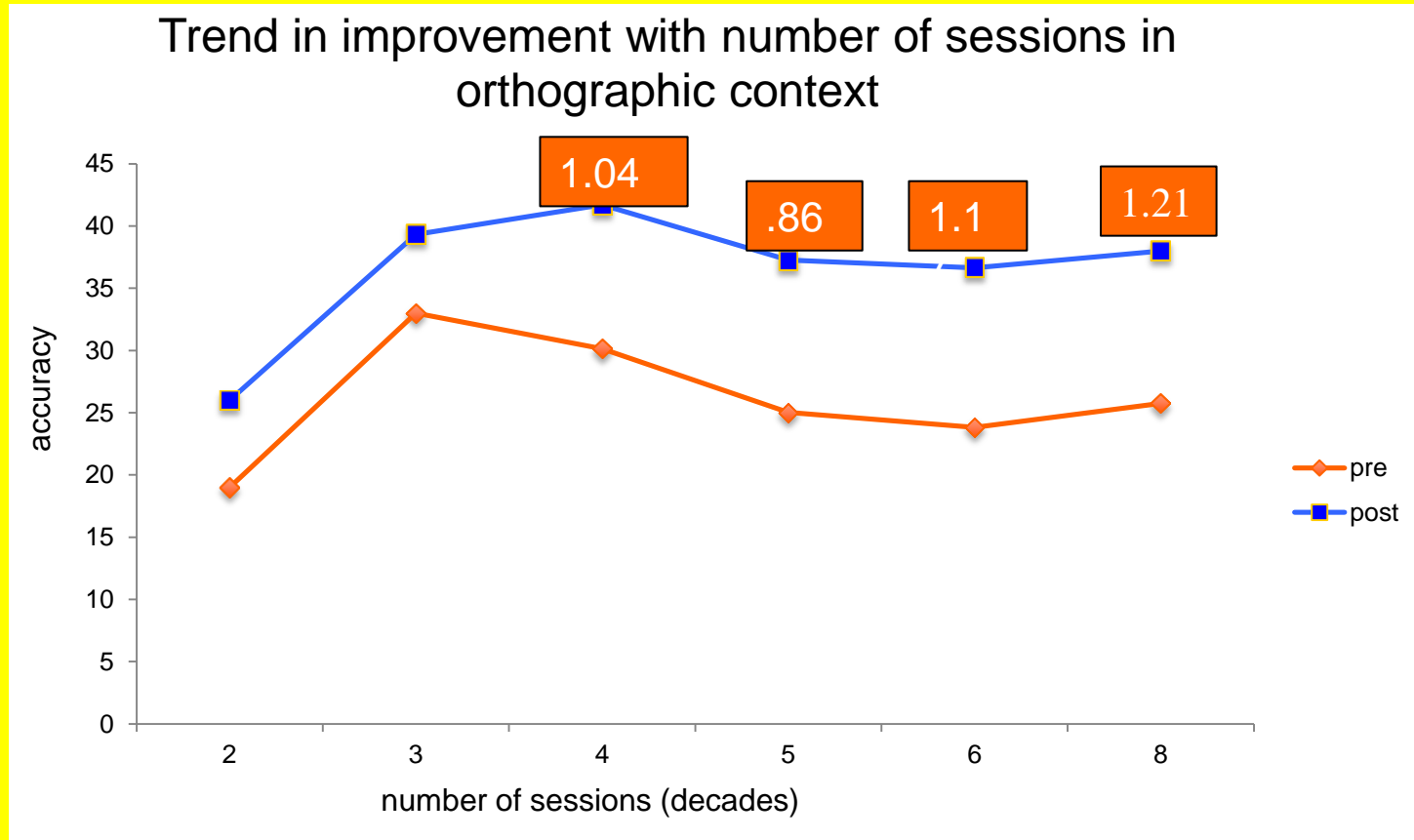




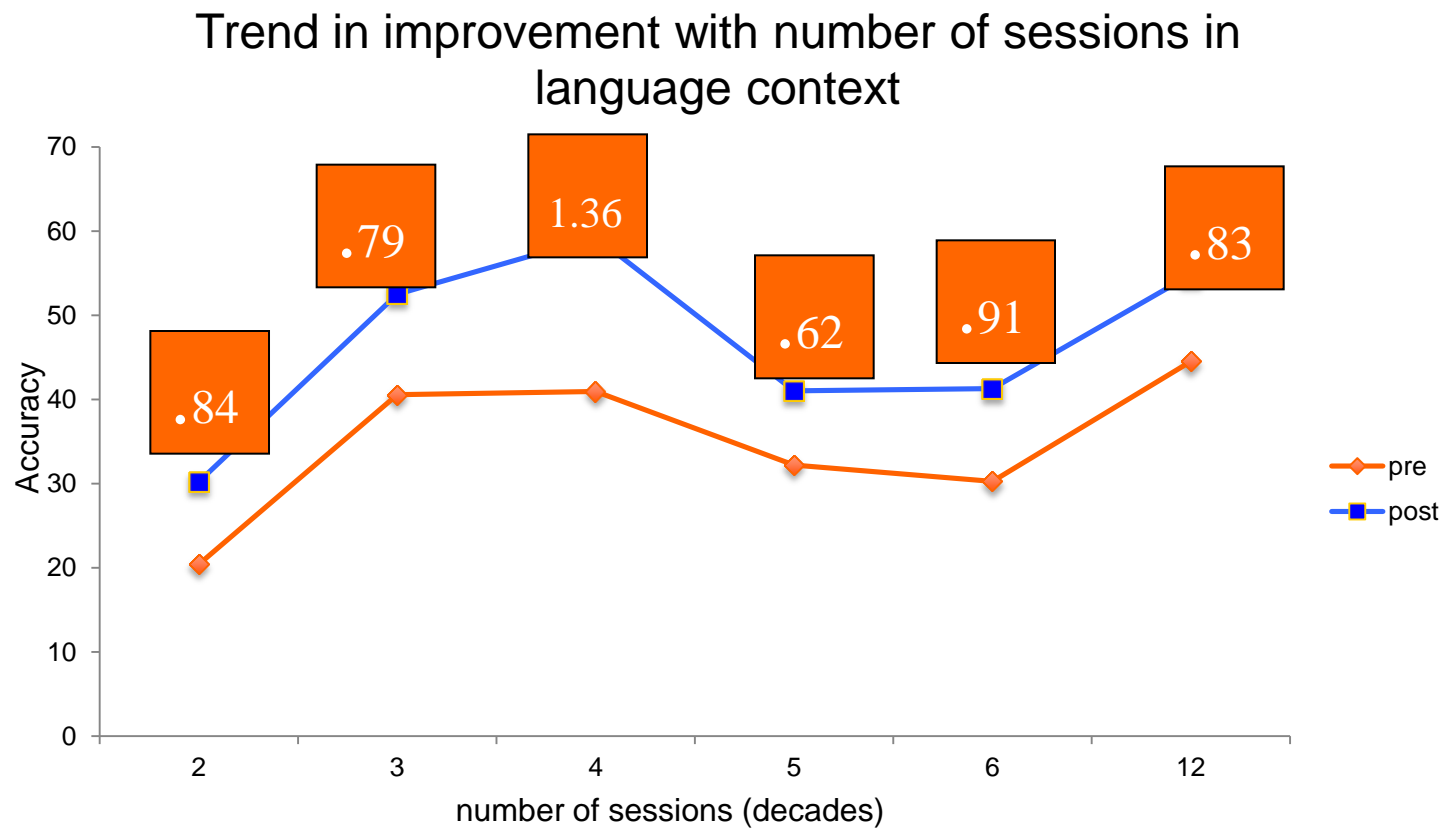
# The influence of the number of lessons on improvement in the phonological intervention



# The influence of the number of lessons on improvement in the orthographic intervention



# The influence of the number of lessons on improvement in the language intervention



# Effect for each reading profile at each year level

Possible only for profiles with  $n > 10$  students : at risk in all three areas or at risk in accuracy and comprehension (profiles 1 and 2 respectively).

The pattern shows the complexity of teaching reading. The patterns of interactions varied.

For 2<sup>nd</sup> yos : learning profiles 1, 2 and 8. Neither total number of teaching sessions nor their weekly frequency influenced reading accuracy for any profile. it was not influenced by the ERIK path chosen.

For 3<sup>rd</sup> yos : profiles 1 and 2 neither main effect influenced change in accuracy. For both profiles, rate of change in reading x number of lessons was significant

For profile 2 rate of change in reading was influenced by weekly frequency and intervention intervention pathway.

For those who underachieve in all three areas, different levels of improvement required different total numbers of sessions and different frequencies in different interventions.

For 4<sup>th</sup> yos ,profile 1 gain was influenced both by the intervention pathway, its interaction with both the total number of lessons and also with the weekly frequency of teaching.

# Improvement in Neale comprehension scores

ANOVA : comprehension improved and this was influenced by most of the main effects.

**Number of years of schooling** influenced the improvement. students in different YOS improved to different extents. The rate was affected by the weekly frequency of lesson.

**The interventions** did not differ in their influence on the improvement. The rate of improvement did not differ across the interventions. Weekly frequency didn't change a pathway's effectiveness. It did vary with YOS. Different interventions required different total numbers of lessons to achieve the same level of improvement.

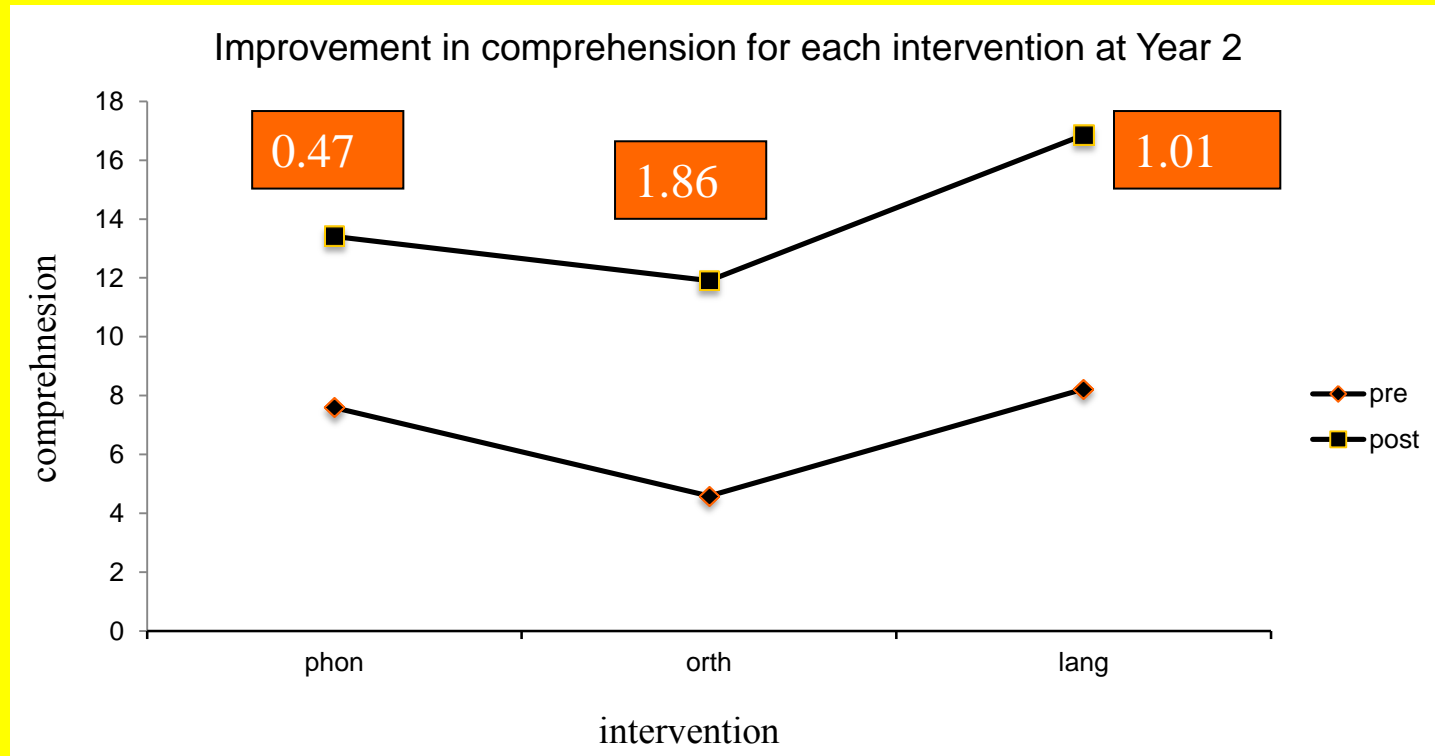
**Total number of lessons** influenced improvement. Children at different YOS needed different total numbers to achieve the same level of improvement in comprehension. The total number by themselves did not increase the rate of improvement.

The **weekly frequency** had much the same effect at all year levels and for all interventions. Varying it changed the level of improvement. Particular combinations of the number of lessons and weekly frequency led to better improvement and to a faster rate of improvement. This held across the different interventions and the year levels.

**Students' reading profiles** influenced their level of improvement and this changed with YOS. Different reading profiles improved to different extents in different interventions, for different total number of lessons and weekly frequency of lessons.

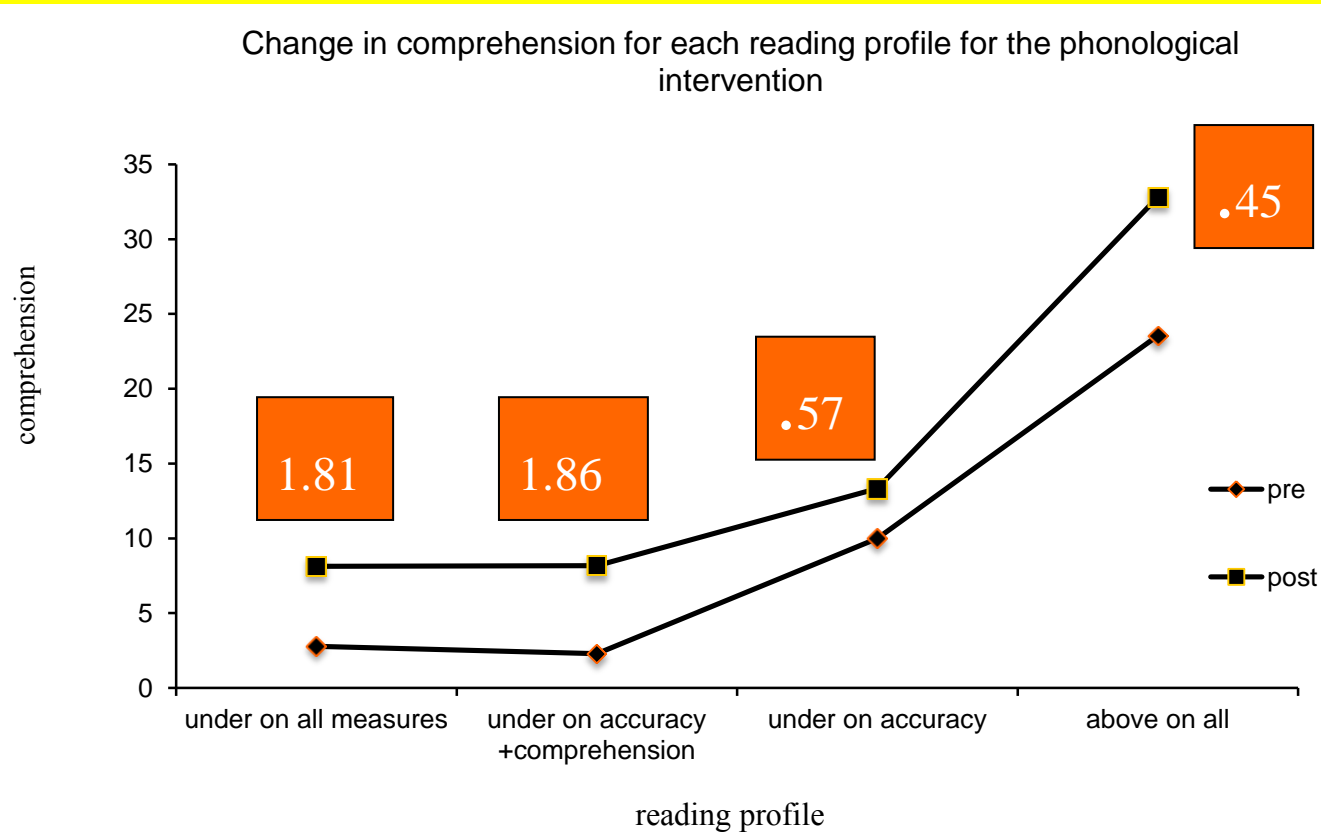
# Improvement in reading comprehension for students in the second year of school

Improvement for each intervention pathway



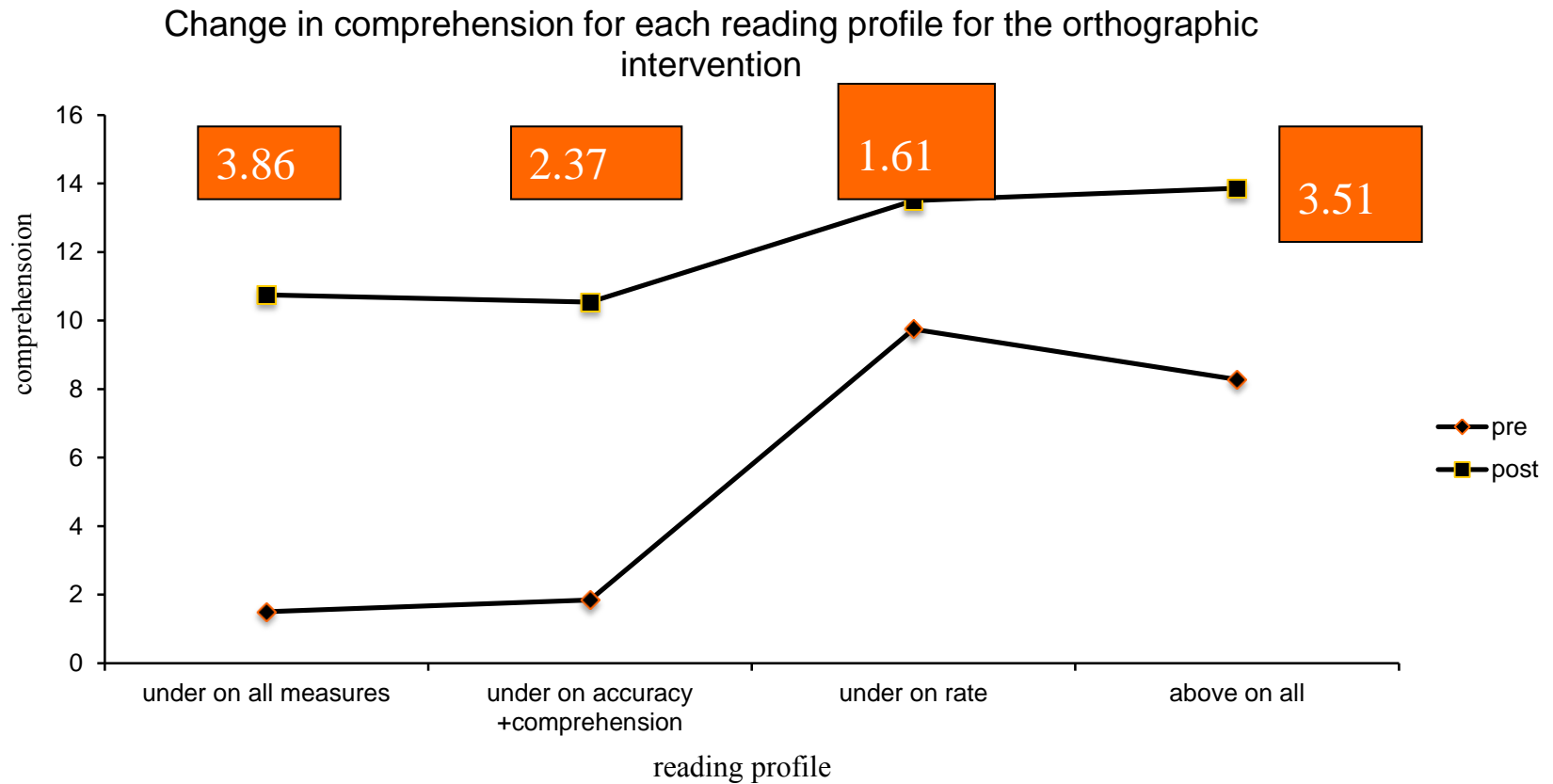
# Improvement in reading comprehension for students in the second year of school

Improvement for each reading profile in the phonological pathway



# Improvement in reading comprehension for students in the second year of school

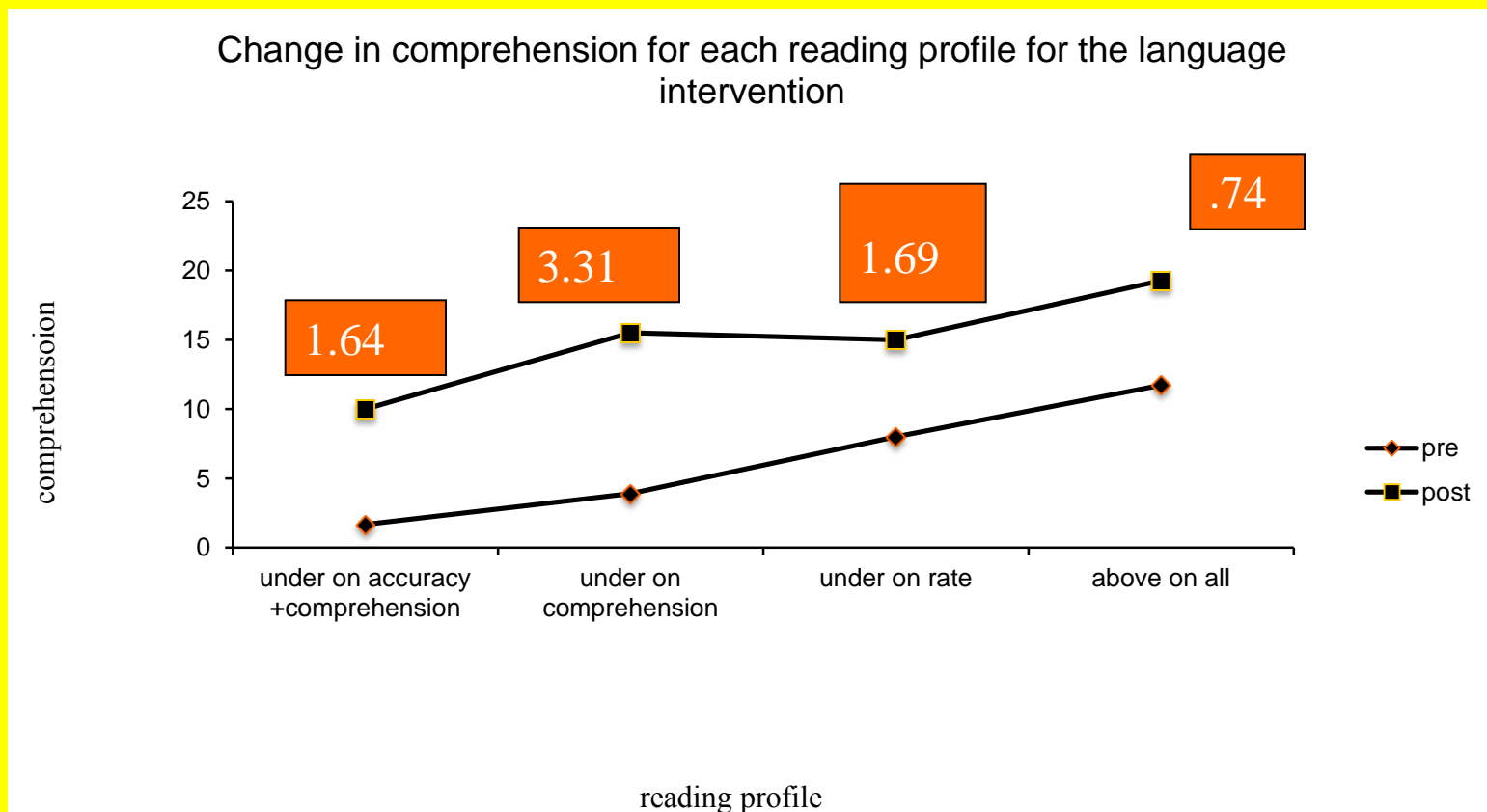
Improvement for each reading profile in the orthographic pathway





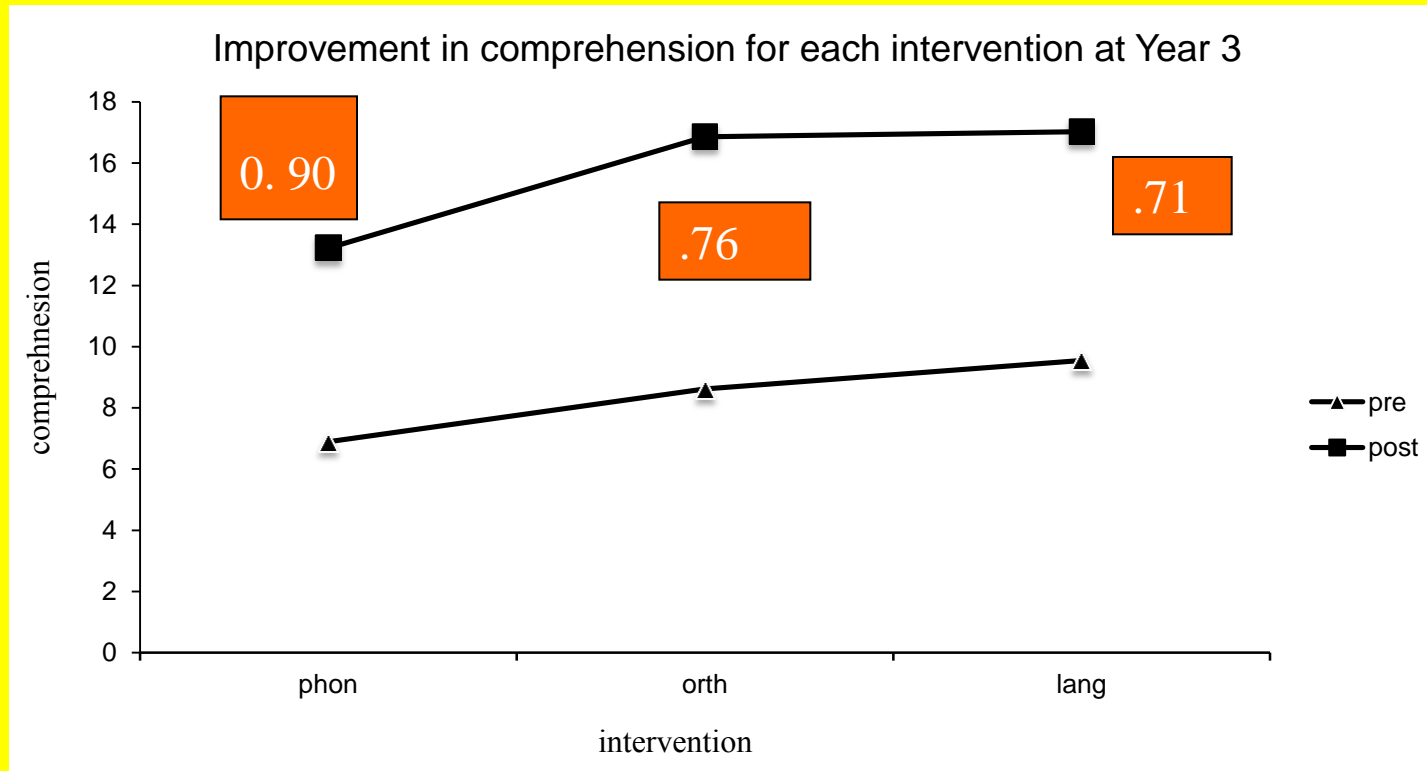
# Improvement in reading comprehension for students in the second year of school

Improvement for each reading profile in the language intervention



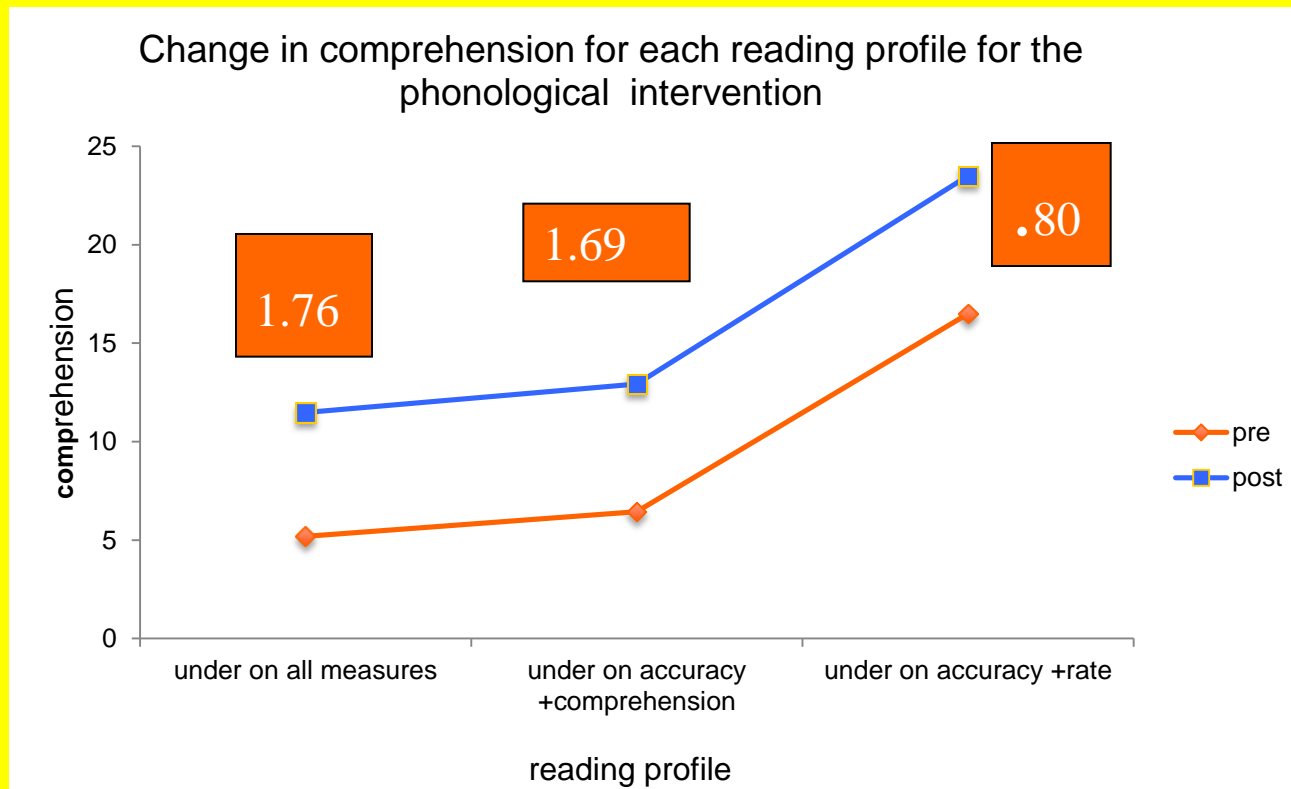
# Improvement in reading comprehension for students in the third year of school

Improvement for each intervention pathway



# Improvement in reading comprehension for students in the third year of school

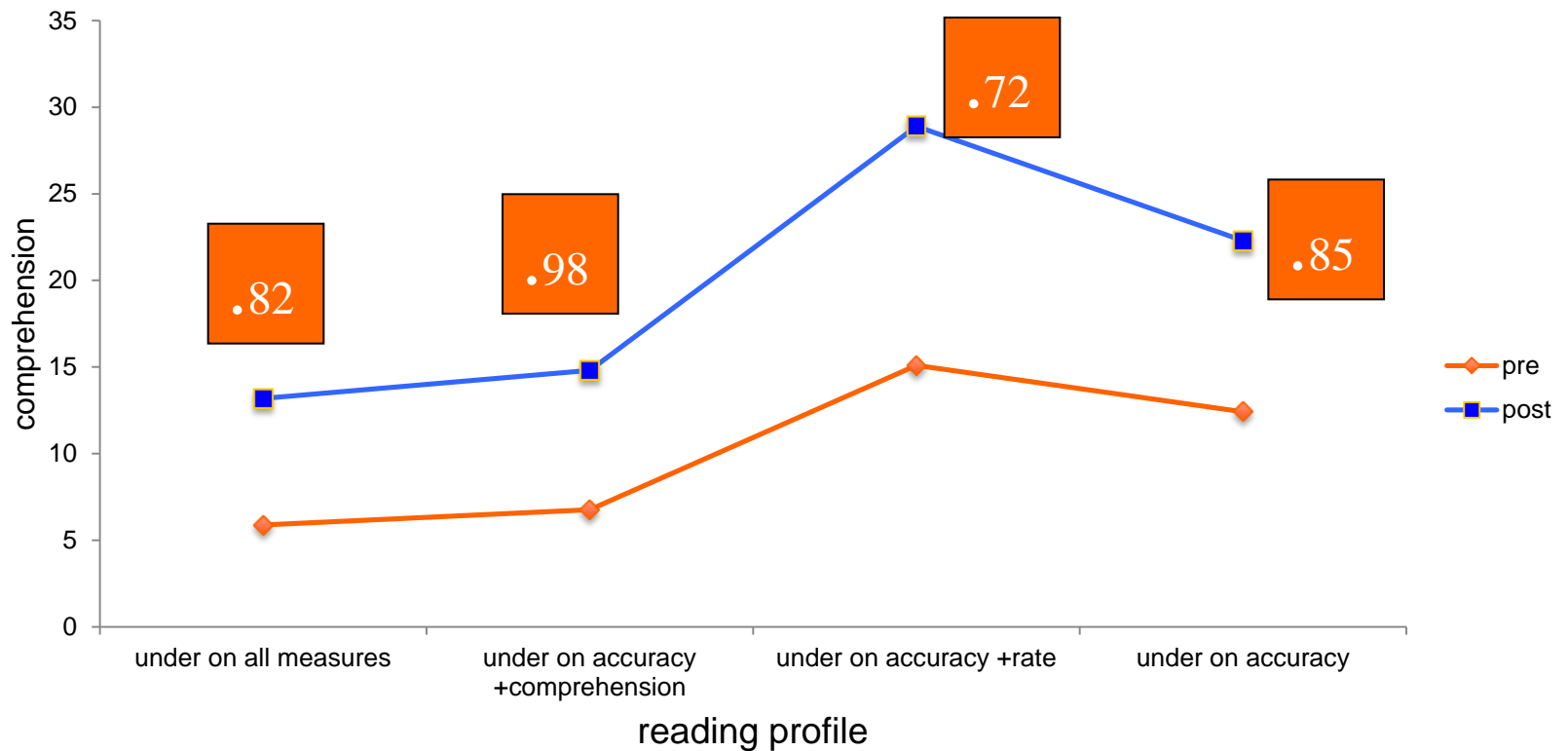
Improvement for each reading profile in the phonological pathway



# Improvement in reading comprehension for students in the third year of school

Improvement for each reading profile in the orthographic pathway

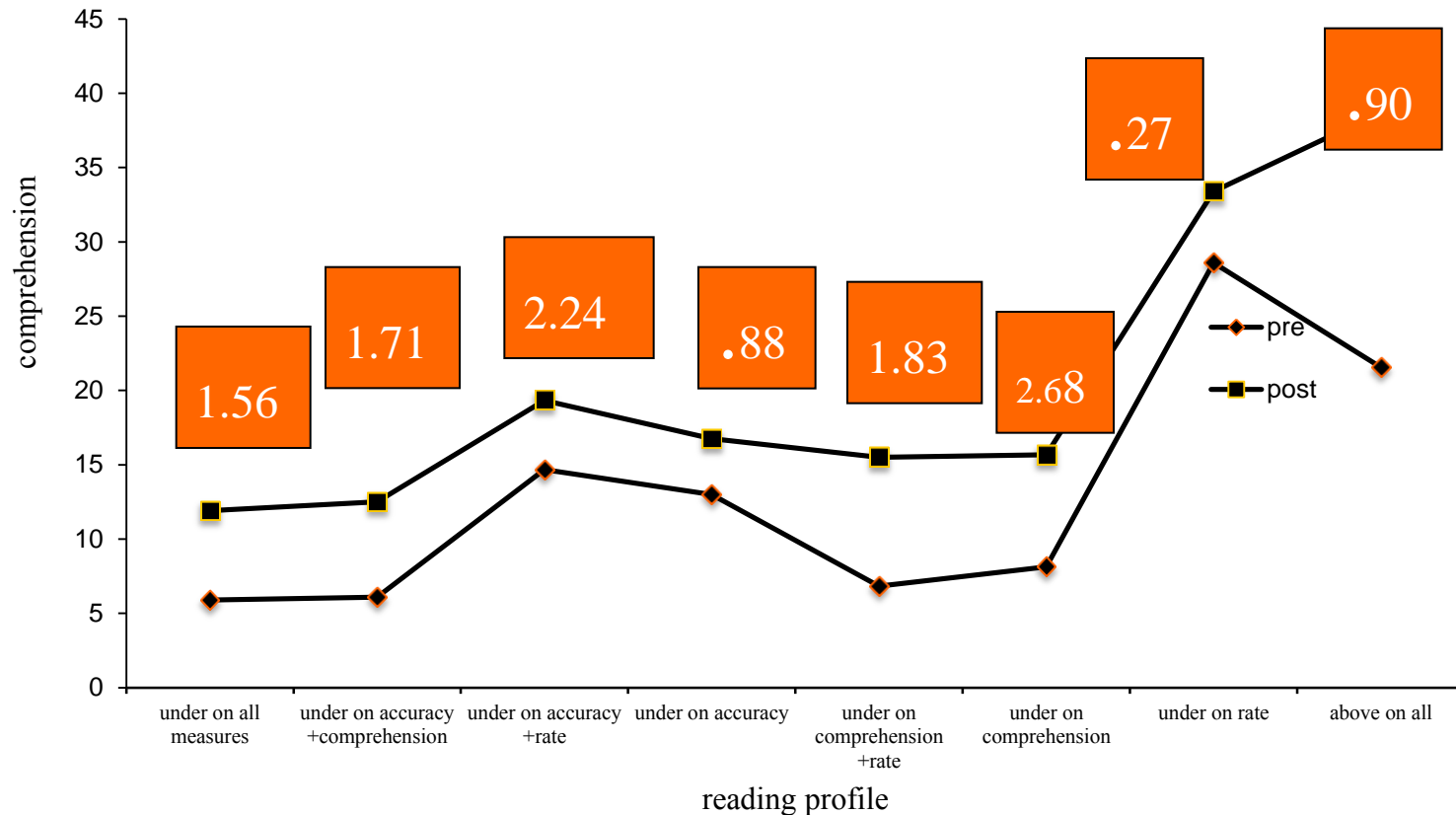
Change in comprehension for each reading profile for the orthographic intervention



# Improvement in reading comprehension for students in the third year of school

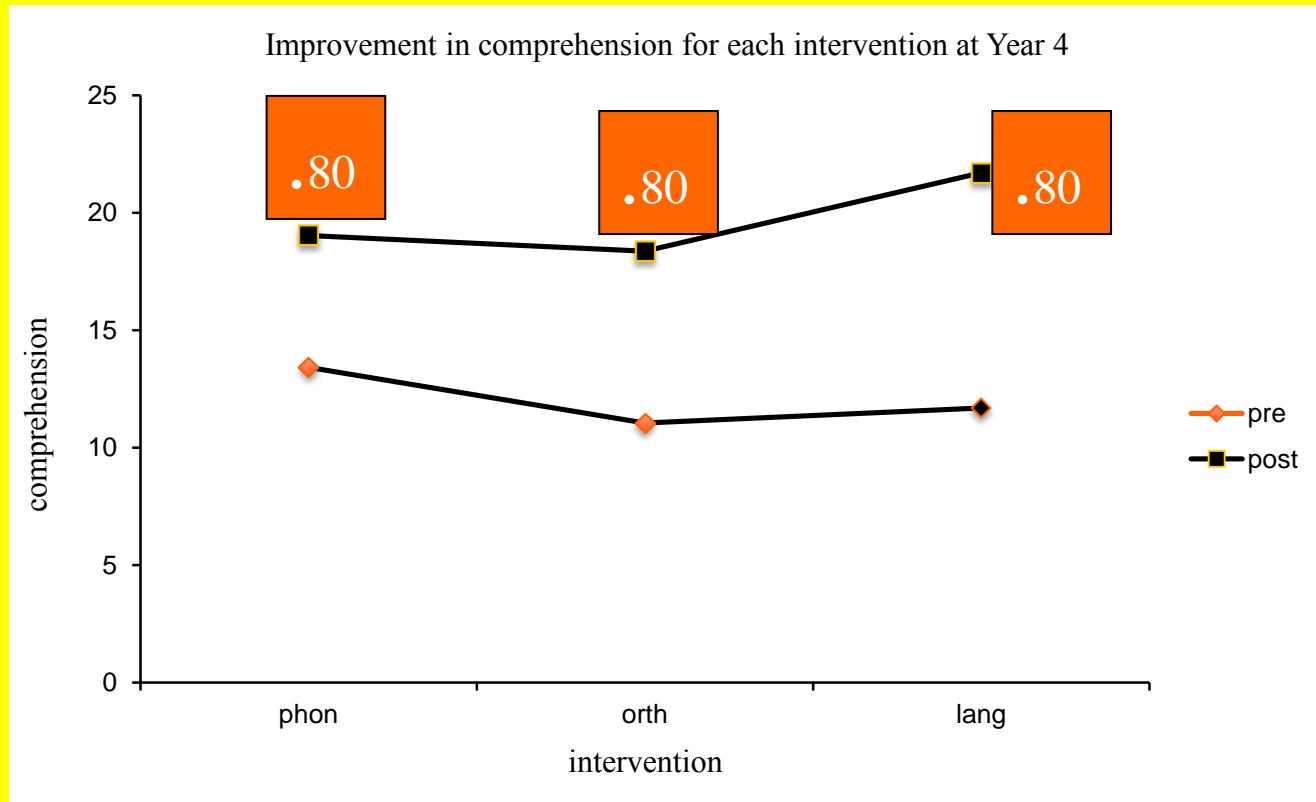
Improvement for each reading profile in the language pathway

Change in comprehension for each reading profile for the language intervention



# Improvement in reading comprehension for students in the fourth year of school

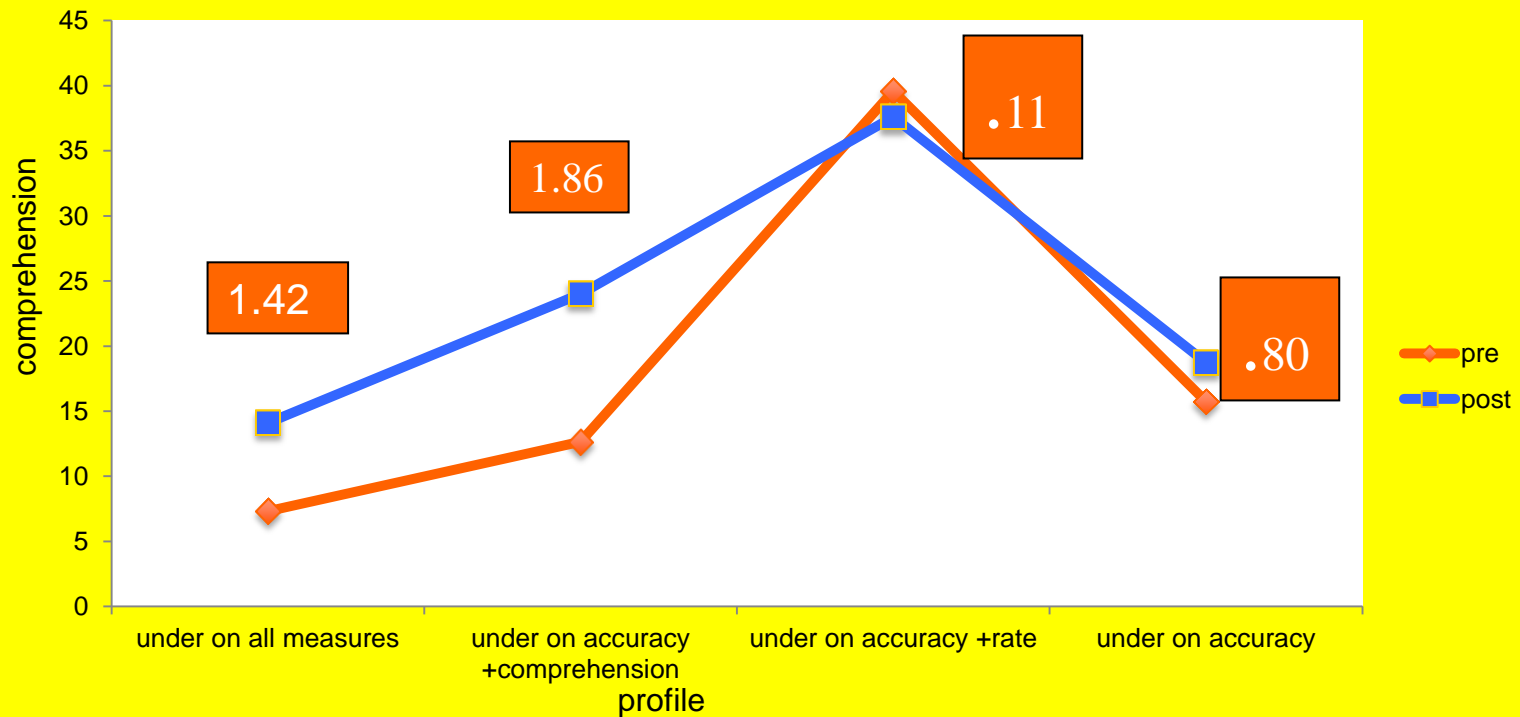
Improvement for each intervention in the fourth year



# Improvement in reading comprehension for students in the fourth year of school

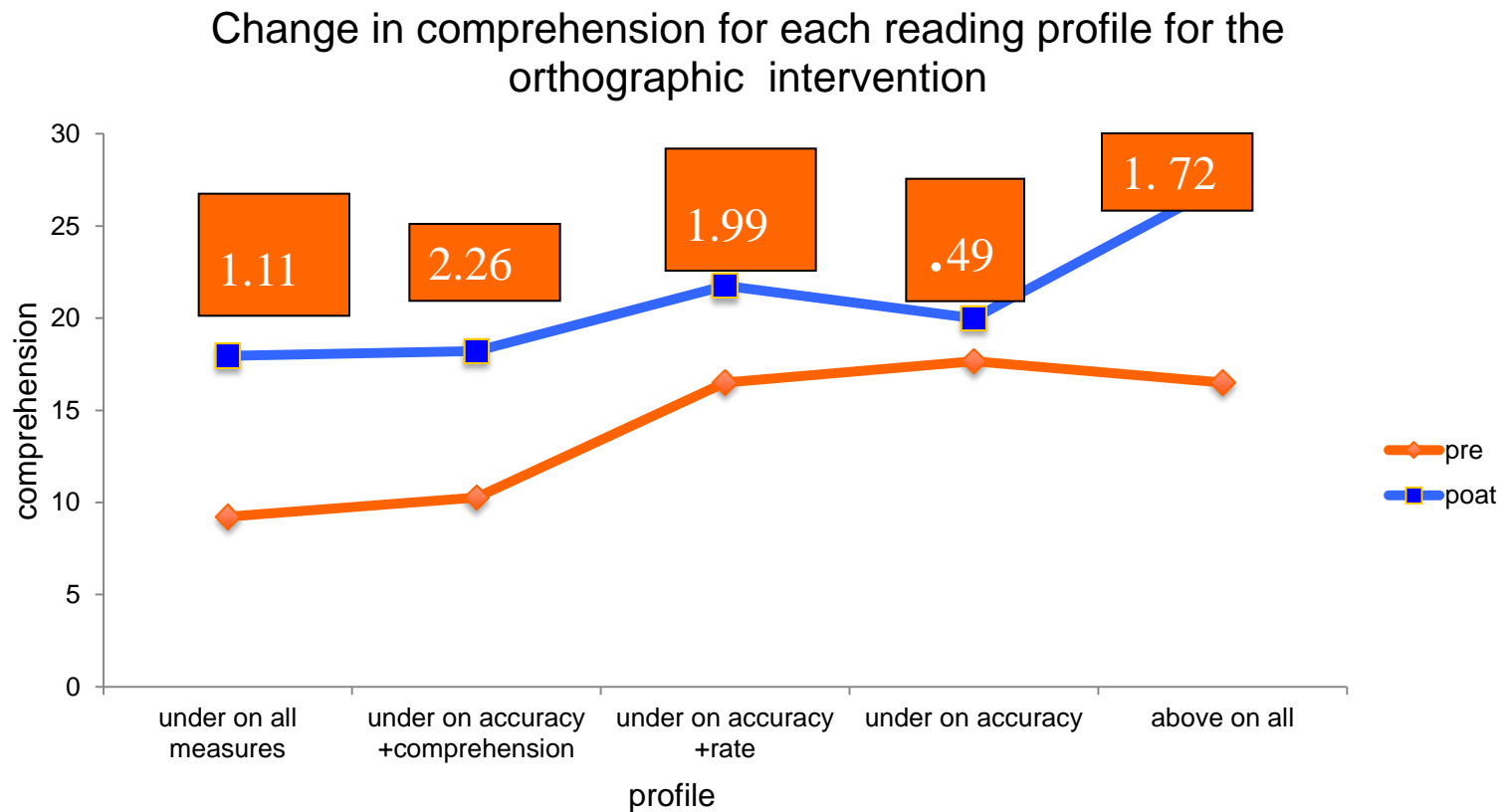
Improvement for each reading profile in the phonological pathway

Change in comprehension for each reading profile for the phonological intervention



# Improvement in reading comprehension for students in the fourth year of school

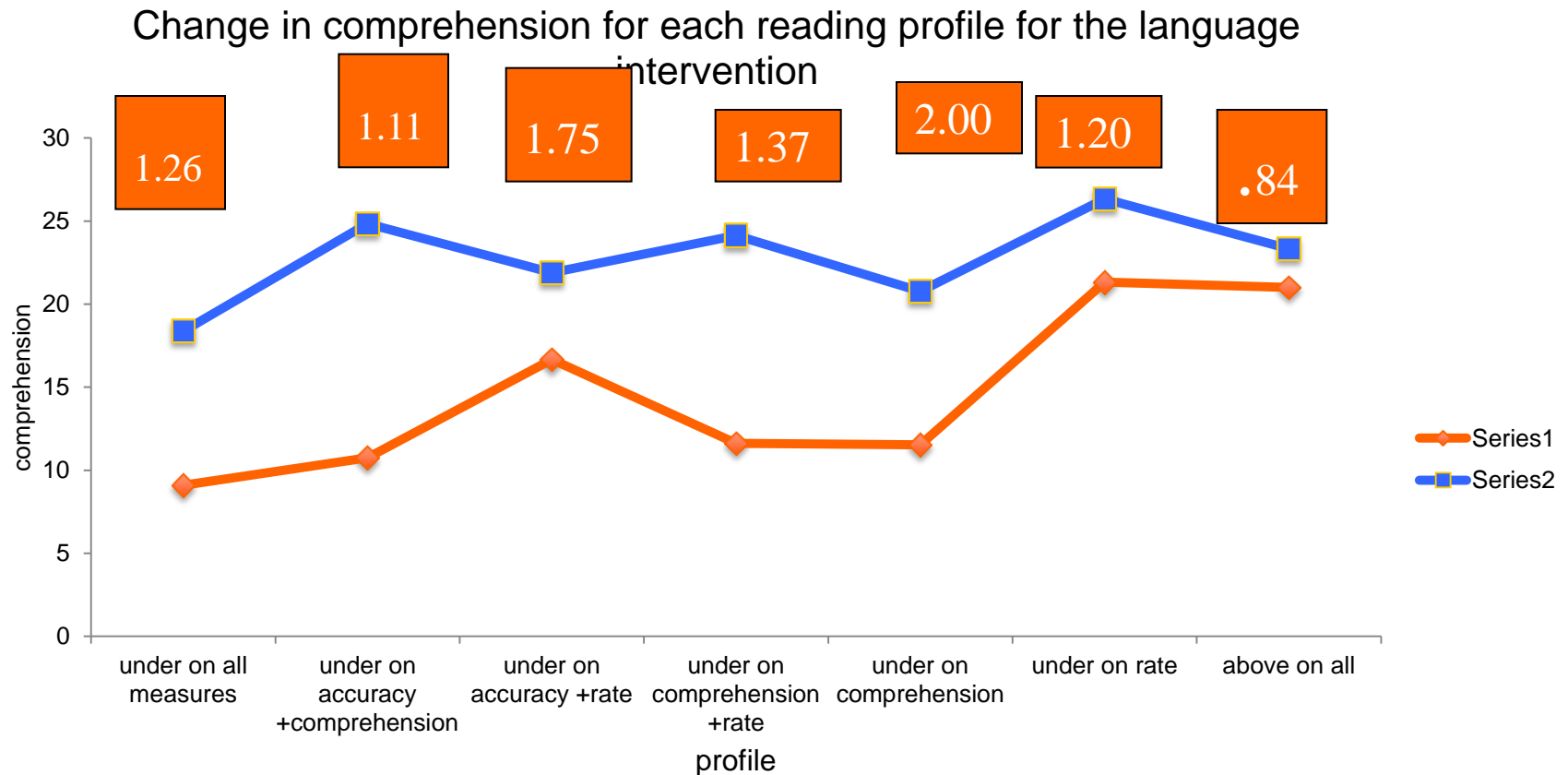
Improvement for each reading profile in the orthographic pathway





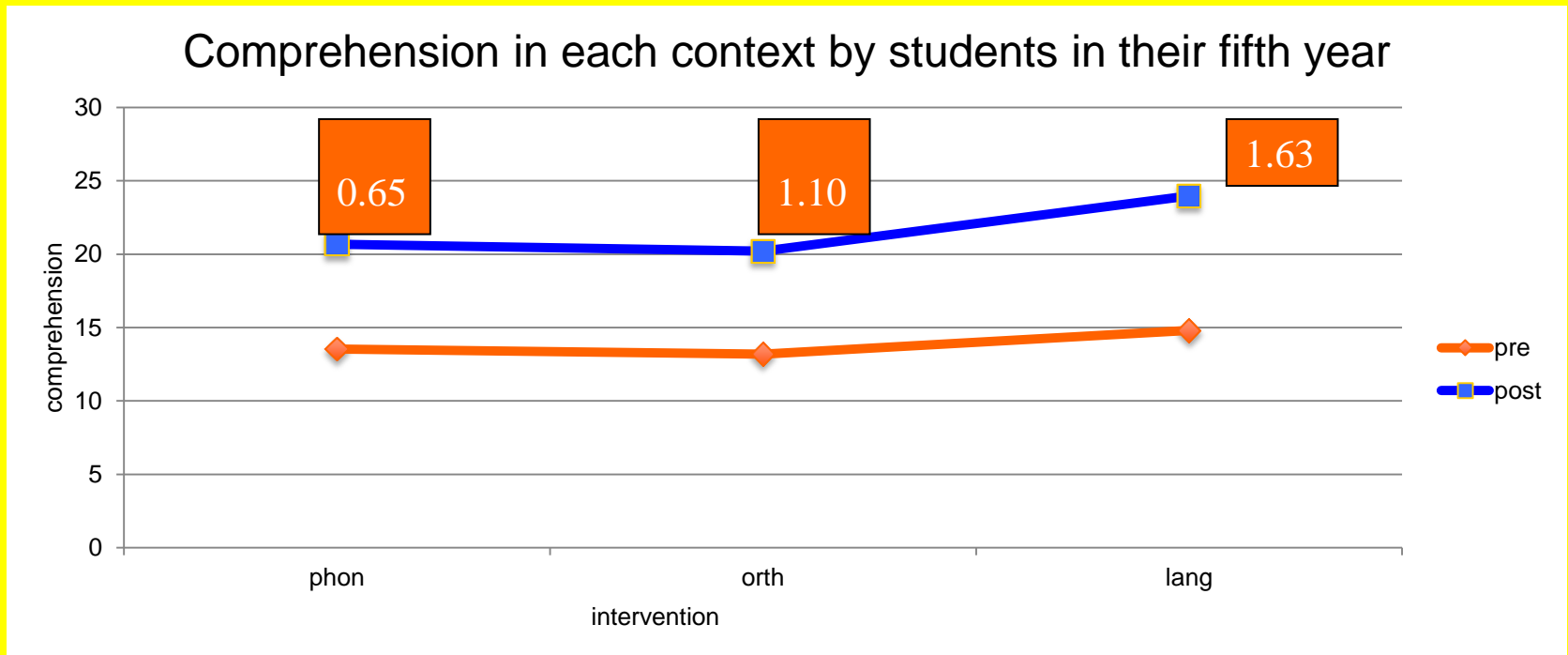
# Improvement in reading comprehension for students in the fourth year of school

Improvement for each reading profile in the language pathway



# Improvement in reading comprehension for students in the fourth year of school

Improvement in comprehension for each intervention in the fifth year



# Effect of Reading Recovery on gains ?

Of the cohort, 231 students were reported to have had Reading Recovery earlier and 355 students hadn't.

	Not RR		RR		T-test
	Mean	Std.	Mean	Std.	
Neale ACC Pre	26.57	13.33	21.84	11.09	4.47**
Neale ACC Post	38.98	13.073	33.34	12.61	5.05**
Neale COMP Pre	10.65	9.96	7.96	5.71	3.71**
Neale COMP Post	18.20	12.13	13.74	7.29	4.89**
Gain in accuracy	12.33	8.92	11.75	7.99	.78
Gain in comprehension	7.49	7.67	5.81	4.73	2.90**

# Improvement in Neale comprehension scores

This analysis that influence of the total number of lessons and their weekly frequency on improvement in reading comprehension is a complex relationship.

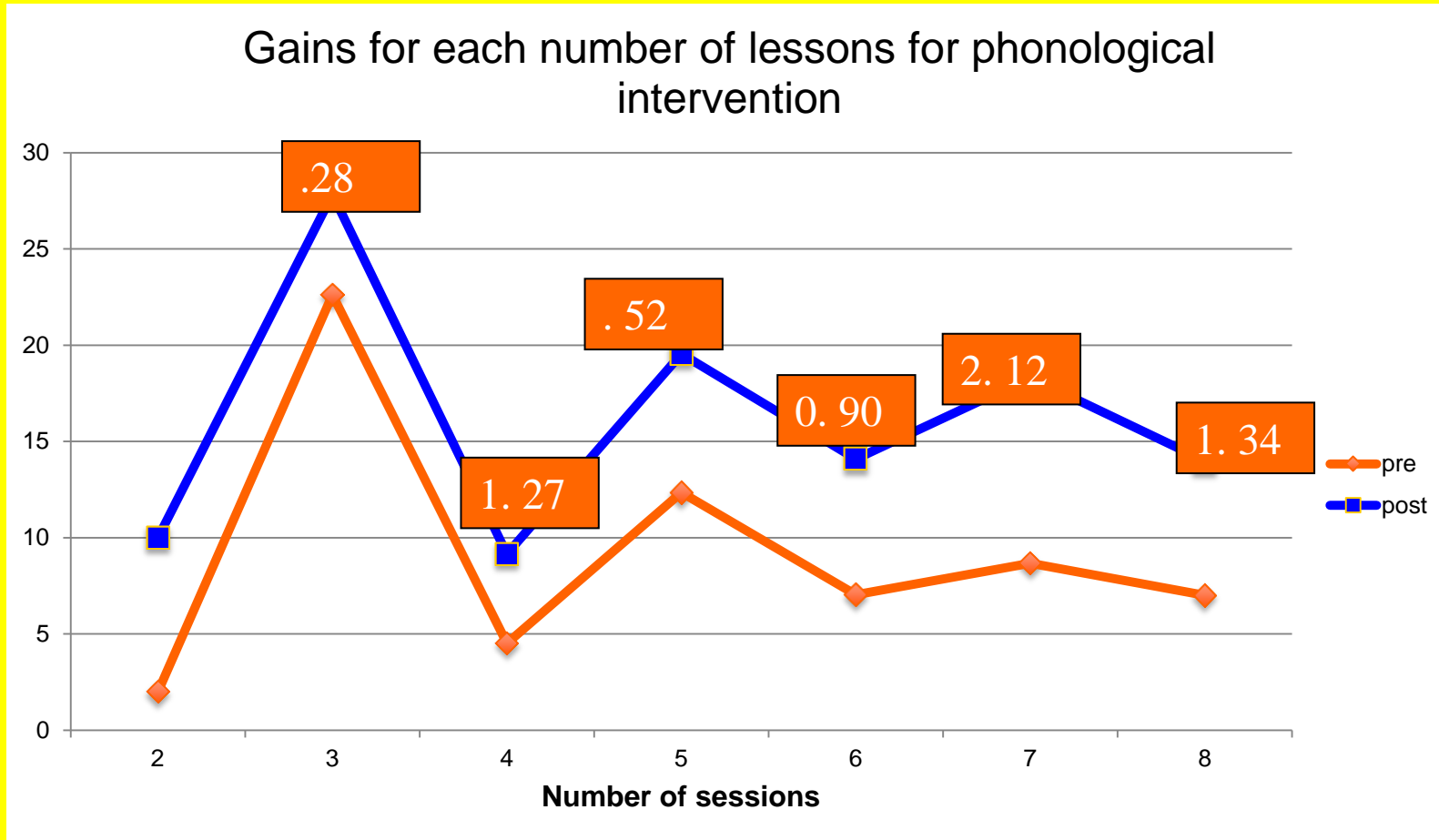
First, it depends on the intervention pathway selected. However, neither the total number of lessons nor the number of lessons per week emerged as significant main effects.

The interaction effects show this complexity. Different intervention pathways require different weekly frequencies of teaching and different total durations

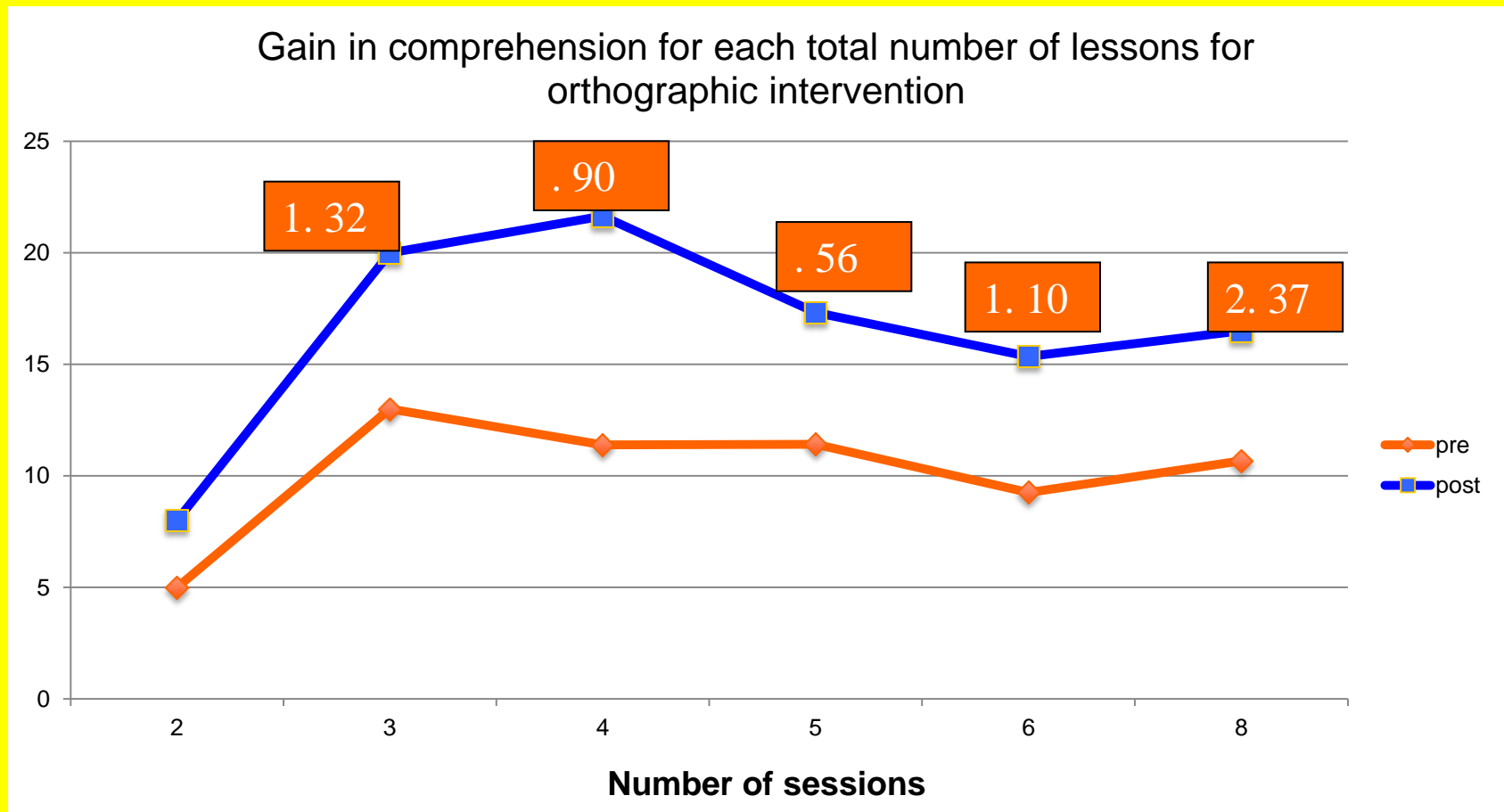
These outcomes for the cohort as a whole are somewhat surprising. They suggest that making decisions to increase reading comprehension either by simply increasing either the total number of lessons or the number of session each week may not be as effective as also taking account of the intervention pathway selected.

One might expect as well that these decisions need to take account of students' learning profiles and years of schooling. The following section examines the influence of these variables for learning profiles at the various year levels.

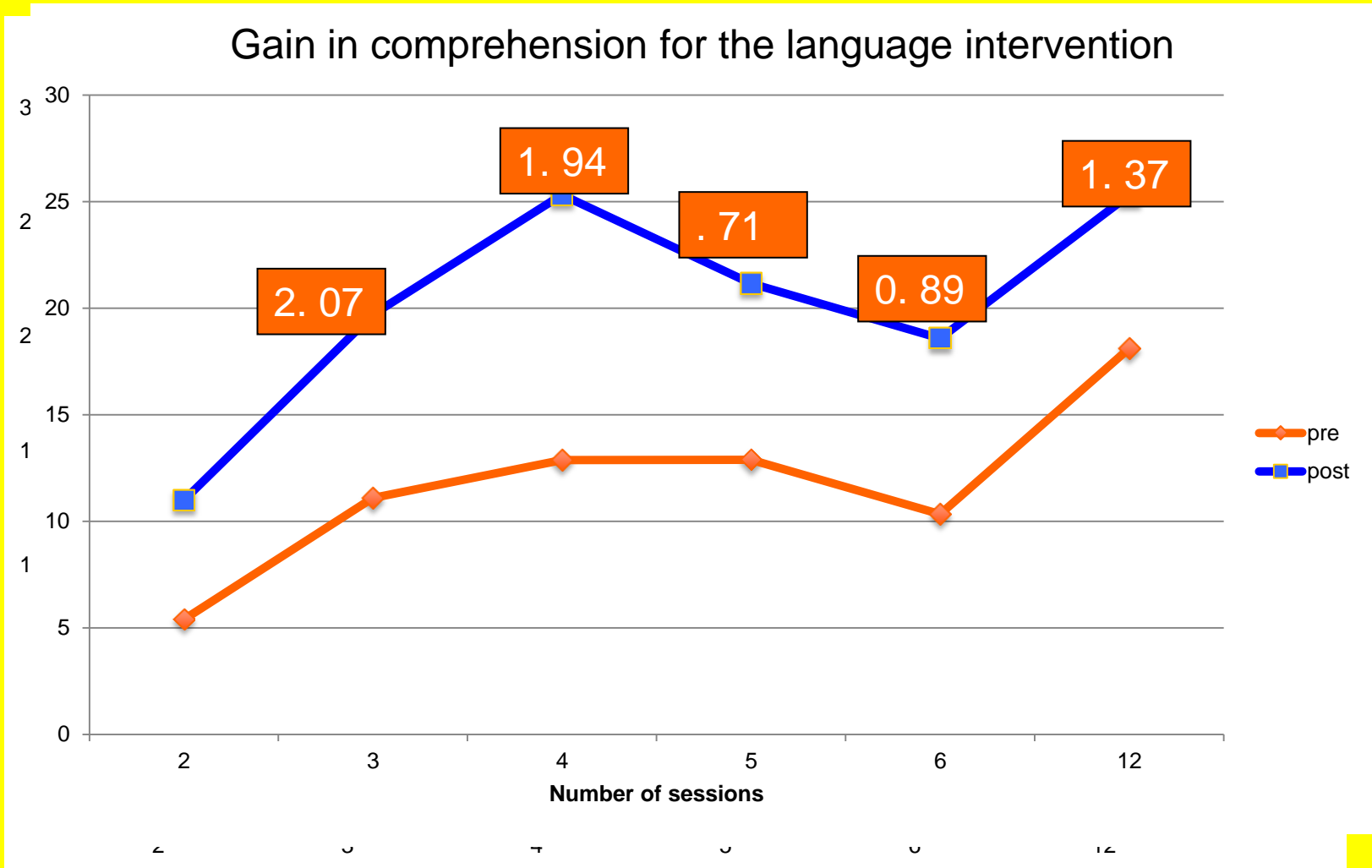
# The influence of the number of lessons on improvement in the phonological intervention



# The influence of the number of lessons on improvement in the orthographic intervention



# The influence of the number of lessons on improvement in the orthographic intervention



# Implications for the future

- Procedures for identifying particular literacy learning profiles more accurately and an enhanced set of validated placement tasks.

The current literacy learning profile tasks have been normed to grade 2. These could be enhanced with vocabulary tasks, better listening comprehension tasks paraphrasing and summarizing skills and word reading tasks.

- Clarify the connection between the phonological and orthographic pathways. Students with better phonological skills were in the orthographic pathway. After developing ERIK we developed PERI. We need both but do we integrate them into one pathway and have multiple entry points ?

- Make more explicit the learning framework that underpins the three pathways. and how to move from scaffolding particular strategies to independent use. This was an original purpose of having every fifth session as a review activity.



# Implications for the future

- Greater explicit focus on building each student's identity as a literacy user. Target explicitly students' intrinsic motivation to engage in reading and what they tell themselves about reading, their self efficacy as readers, their agency as readers, the potential values of reading and the status of reading in their lives and the lives of significant others.
- A revised focus on the format for our intervention. The small group intervention is valuable. A RTI model with gradual transfer back to the classroom with the capacity to gradually embed classroom texts in the ERIK program, more seamless links with regular teaching with the classroom teacher collecting ongoing data monitoring for ERIK students.
- Clearer indicators of when to cease a student's involvement in a pathway, to discontinue or when to switch to another pathway. I would recommend basing it on their capacity to read over an extended period,

# Implications for the future

- Clearer indicators of when to cease a student's involvement in a pathway, to discontinue or when to switch to another pathway. I would recommend basing it on their capacity to read over an extended period,

I recommend clear indicators based on a student's ability to read and comprehend independently particular types of texts and words.

This was a purpose of having every fifth session as a review activity. Not only was it intended to review but also to assess a student's progress. I would recommend including short assessment tasks. A criterion could be the student's ability to read and comprehend independently appropriate text over a four successive review sessions. These tasks could now be delivered on line in much the same way as On Demand Testing.

- Teaching and texts that are more appropriate for older primary students
- Increased inferential and evaluative comprehension type teaching. This is why we may not be getting a large impact on nap plan darter at this point.
- We need long term retention data and transfer.

# The three intervention pathways

## ERIK

### *Phonological awareness pathway.*

Each session teaches a spoken onset and/or rime unit through various phonological and phonemic skills (rhyming, blending and segmenting) and using these to read and spell words and to read prose.

### *Orthographic processing pathway.*

Each session teaches a letter cluster, either a written rime or a written onset for one syllable words.

It teaches word reading skills (segmenting and blending to read written words) and using these in reading and writing activities.

### *Oral language pathway.*

Each session teaches a comprehending strategy first in oral language contexts and then applied to reading.

The teaching sequence:

- inferring the topic of the text and questions it might answer;
- visualizing sentences and paraphrasing sentences.

# The structure of each session

Each session comprised the following types of learning activities: students

- recall what they learnt from earlier session by re-reading text from the previous session.
- learn pathway- specific skills (rhyming, sound blending and spoken word segmenting skills in the phonological pathway, segmenting and blending written words using phonic strategies in the orthographic pathway and application of comprehension strategies in the comprehension pathway).
- read and write target words. **metacognitive control and agency as a reader**
- read relevant prose. **Vocabulary enhancement**
- review explicitly what has been **Paragraph and topic enhancement during reading**

Every fifth session : review session. **Awareness of pacing one' self as a reader**

Re-administer prose and isolated **Closer link with writing** reading skills for text similar to those used on intervention teaching and build students' reading self-efficacy.

**Morphographic knowledge**

**Very best wishes with  
your future work**