

# Ascending the ORF Slope: Three Two Methods to Identify Meaningful ORF Plateaus

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## Abstract

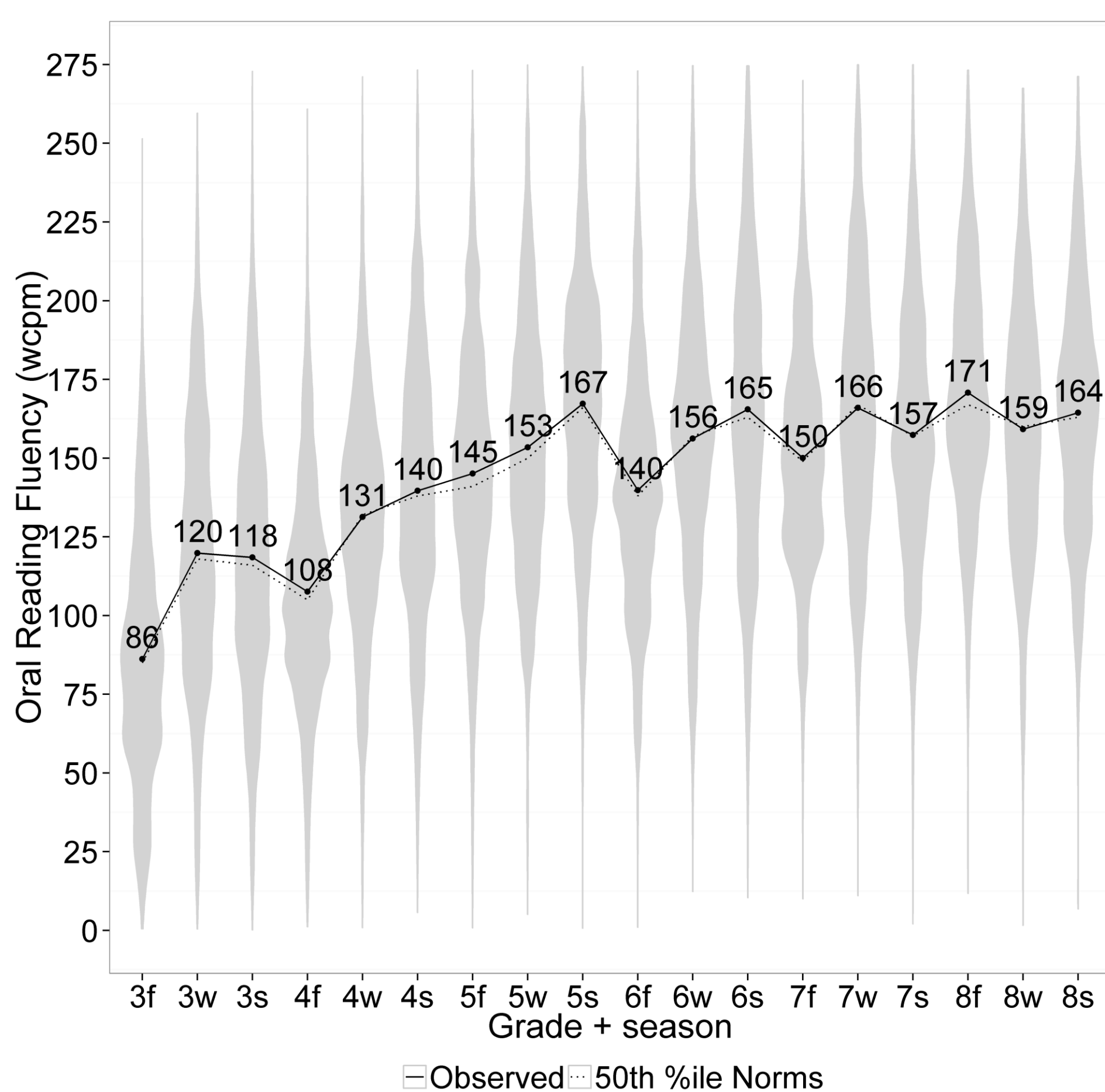
Oral reading fluency (ORF) is a ubiquitous classroom assessment used in Response to Intervention (RTI) models across the country to identify struggling readers and inform instructional decisions (Tindal, 2013). Although ORF scores have shown to be reliable predictors of reading proficiency through middle school, the point at which ORF assessments fail to provide additional information about reading ability is unclear (Francis et al., 1996). The purpose of this study is to estimate an ORF score plateau range that represents the transition from acquisition to mastery for different groups of students.

## Method

**Measure.** easyCBM (Alonzo et al., 2006) Passage Reading Fluency (PRF) benchmark measures (fall, winter, spring) used at each of Grades 3-8 (18 occasions). Scores are number of words read correctly per minute (wcpm).

**Sample.** Sequential cohort design with a convenience sample of 13,965 Grade 3-8 students from 2009/10 – 2013/14.

Grade	2009/10	2010/11	2011/12	2012/13	2013/14
3	891	1829	6545		
4	741	1402	3218	6449	
5		1140	2268	3218	6449
6			2030	2268	3218
7				2030	2268
8					2030



**Analyses.** We compared three two methods to derive the ORF plateau (Mplus 7.3, BAYES estimator; Muthén & Muthén, 1998-2012).

- CI Overlap:** ORF plateau defined as the time  $t_n$  at which the estimated mean is not credibly different than that at  $t_{n+1}$ .
- First Derivative:** ORF plateau defined using the credible interval of the first derivative (i.e., slope of tangent equals zero; Singer & Willett, 2003) as a model parameter.
- (X) A piecewise linear-linear GMM with unknown knots in which the knot is a parameter to be estimated (Kohli et al., 2013). Unfortunately, we could not get this model to estimate properly given our data. Please try!

## Results

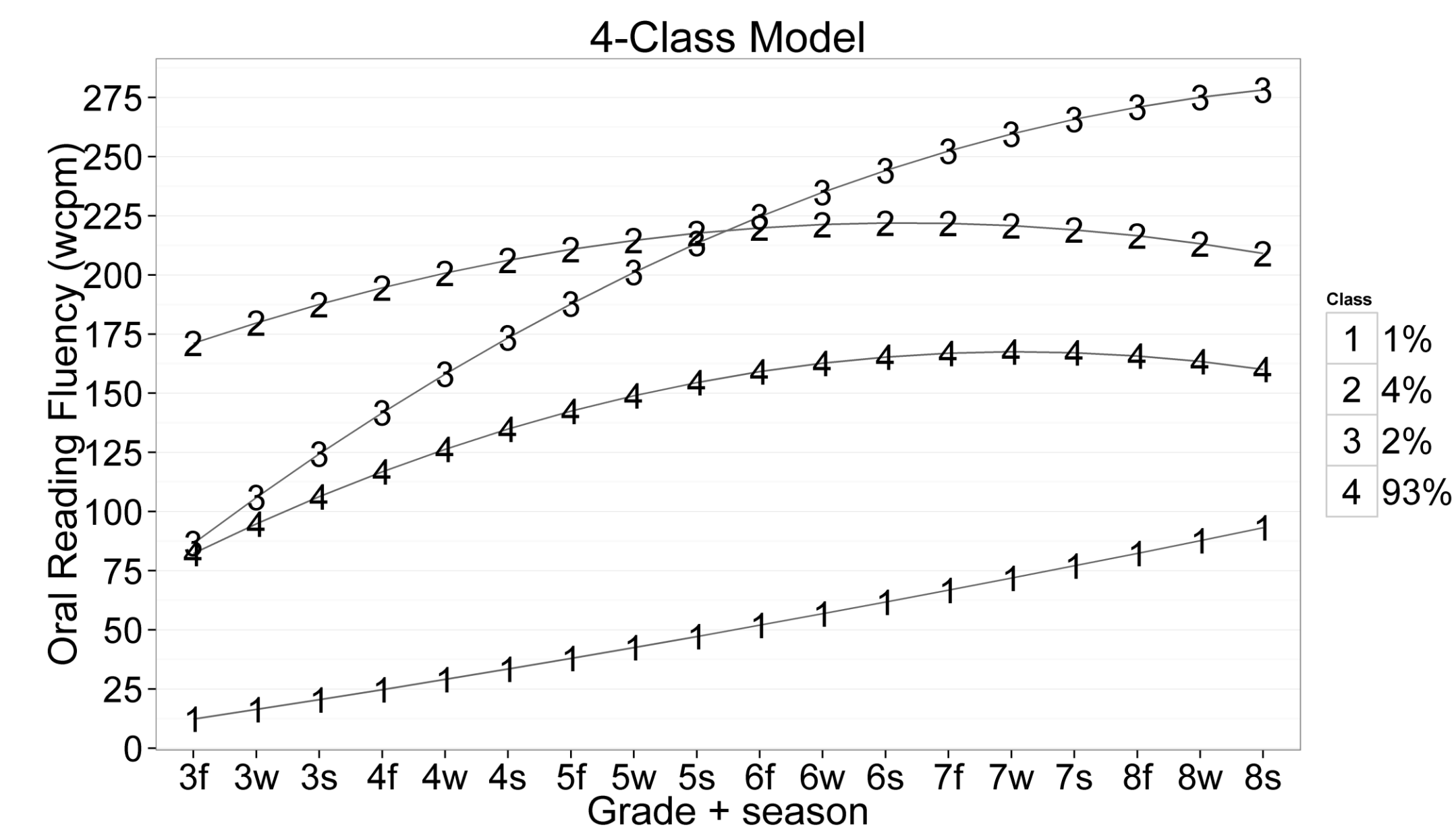
### Quadratic Growth Mixture Models

**Overall Model - Maximum Likelihood estimation:**

- Means (intercept, linear, quadratic) free across ALL classes.
- Slope variances (l, q) constrained equal across ALL classes.
- Residual variances constrained equal across ALL classes.

**4-Class Specifications:**

- Class 1: Intercept variance fixed at zero.
- Classes 2-4: Slope variances constrained equal across classes.



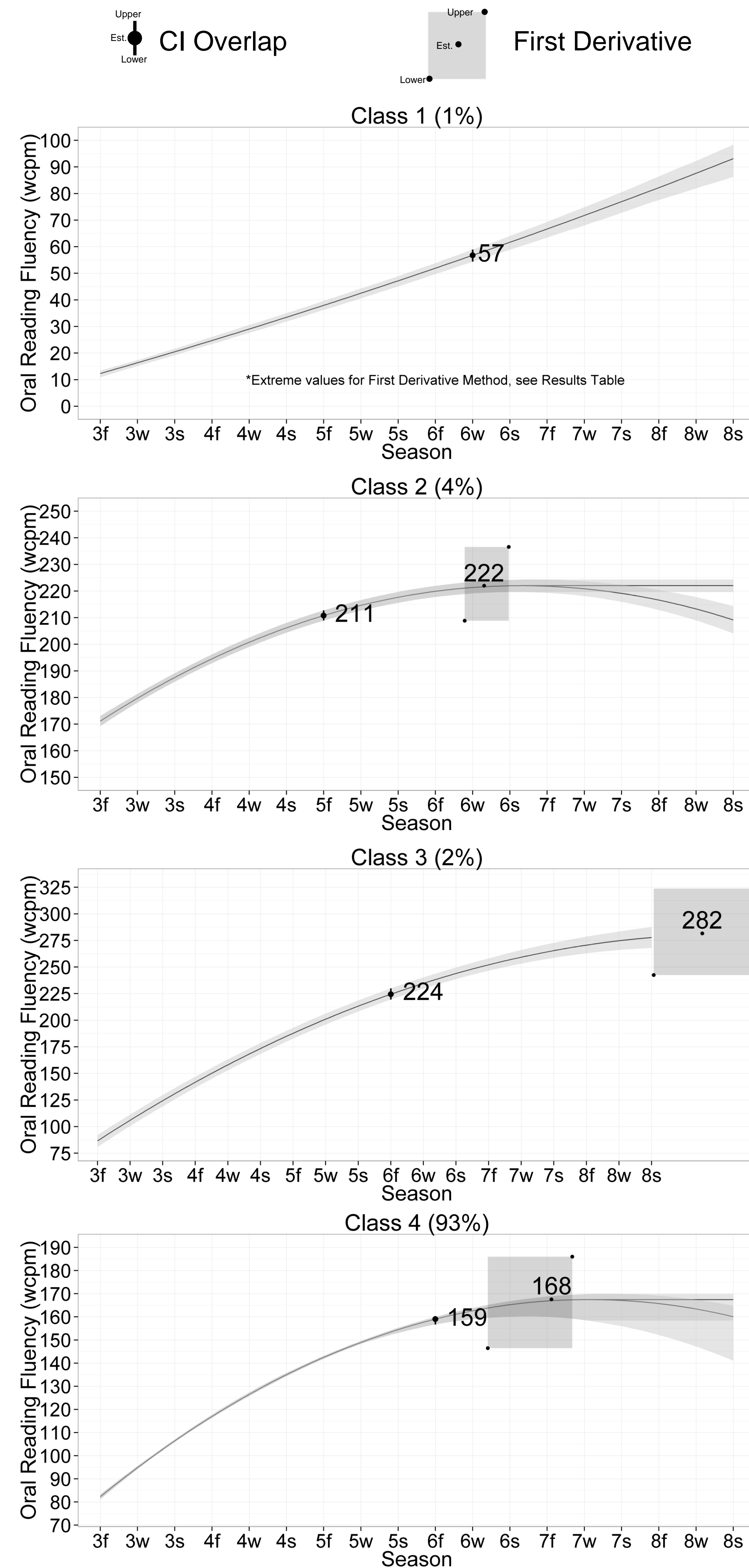
Model	BIC	VLMR p-value	BLR p-value
2-Class	1265751	.0000	.0000
3-Class	1265539	.0000	.0000
4-Class	1265531	.0000	.0000
5-Class	1265413	.0001	.0000

## Funding Sources

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### Quadratic Latent Growth Curve Models

Estimated separately for each class, using the BAYES estimator (default, non-informative prior distributions), and applied two methods to derive ORF plateaus.



### Results Table

Class n (%)		CI Overlap			First Derivative		
		Lower	Est.	Upper	Lower	Est.	Upper
Class 1 186 (1)	ORF Plateau	54	57	59	-220	280	6877
	Grade+season (time)	--	6w	--	NA	17w	93w
Class 2 581 (4)	ORF Plateau	209	211	213	209	222	237
	Grade+season (time)	--	5f	--	6f	6w	6w
Class 3 241 (2)	ORF Plateau	219	224	230	242	282	324
	Grade+season (time)	--	6f	--	8s	9f	9s
Class 4 12957 (93)	ORF Plateau	157	159	160	146	168	186
	Grade+season (time)	--	6f	--	6w	7f	7f

## Discussion

The average ORF plateau range for the majority of the sample was approximately **159-167 wcpm**, or more conservatively, 146-186 wcpm.

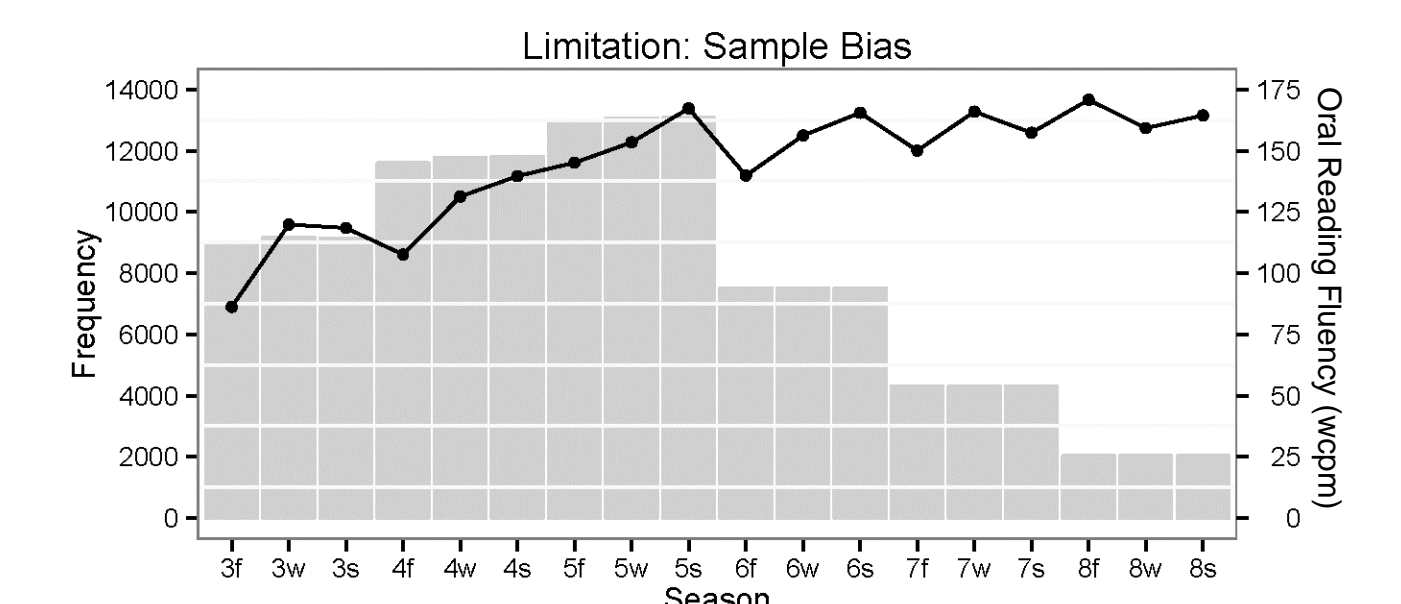
### Methodological Implications:

- First Derivative is perhaps most intuitive method, BUT
  - Will not work for linear slopes (Class 1), AND
  - Plateau may be beyond measured time (Class 4).
- CI Overlap plateau  $mean(t_n)$  not necessarily credibly different from  $mean(t_{n+x})$ .
- Piecewise latent GMM with estimated knots an appealing alternative (Kohli et al., 2013).

### Practical Implications:

- Results converge on similar past research: Less predictive utility around 150 wcpm, generally achieved by Grade 5-6 (Hosp & Fuchs, 2005).

### Limitation:



### Conclusion:

Many approaches to determine the point (ORF score or time) from acquisition to mastery for different groups of students to signal cessation of ORF assessment, saving resources and moving to more appropriate measures.

## References

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## Further Information

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More information on this and related projects can be obtained at <http://brtprojects.org> and <http://ncaase.com>.