An Exploration of Growth Models for Within-year Grade 5 Oral Reading Fluency

Joseph F. T. Nese, Akihito Kamata, Rhonda N. T. Nese, Bitnara J. Park, Gerald Tindal
Behavioral Research and Teaching, University of Oregon, 2012

Abstract
Oral reading fluency (ORF) is the academic construct most often assessed using curriculum-based measurement (CBM) as part of a response-to-intervention (RTI) model, but little empirical work has attempted to examine intra-individual change in CBM ORF. In general, CBM ORF growth studies incorporate only three benchmark testing occasions (fall, winter, spring), which limits the types of growth models that can be explored and the understanding of within-year developmental ORF growth. We examined eight within-year ORF testing occasions and explored latent growth models for 202 students in grade 5. We explored variations in growth modeling to understand more about ORF growth and to understand the methods used to model growth.

Research Objectives
1) Analyzed the effects on the reliability of the slope estimate by comparing:
   a) a regular growth model using "HLM"
   b) a regular growth model using a latent growth model
   c) a latent growth model using two parallel processes (using alternate time points across processes)
2) Used latent class growth analysis (LCGA) to identify and describe theoretically meaningful groups of students based on ORF initial status and growth.

Reliability

<table>
<thead>
<tr>
<th>Model</th>
<th>MSE</th>
<th>M SE</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLM</td>
<td>161.52</td>
<td>3.08</td>
<td>2.65</td>
</tr>
<tr>
<td>Parallel A</td>
<td>165.45</td>
<td>3.23</td>
<td>2.31</td>
</tr>
<tr>
<td>Process B</td>
<td>159.50</td>
<td>2.98</td>
<td>4.32</td>
</tr>
</tbody>
</table>

Fit Information & Reliability for the Three Growth Models

<table>
<thead>
<tr>
<th>Growth Model</th>
<th>AIC</th>
<th>CPI</th>
<th>RMSEA</th>
<th>SMI</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLM</td>
<td>1380.29</td>
<td>.92</td>
<td>.18</td>
<td>.07</td>
<td>.07</td>
</tr>
<tr>
<td>Latent</td>
<td>13781.58</td>
<td>.93</td>
<td>.18</td>
<td>.06</td>
<td>.08</td>
</tr>
<tr>
<td>Parallel Process</td>
<td>14329.76</td>
<td>.74</td>
<td>.38</td>
<td>.55</td>
<td>.04</td>
</tr>
</tbody>
</table>

Latent Class Growth Analyses

Model: AIC 3389.70  14329.19  1391.38  202  000

Results & Class Descriptives for 2-Class Model

<table>
<thead>
<tr>
<th>Intercept</th>
<th>Linear</th>
<th>Quadratic</th>
<th>Cubic</th>
<th>Proficiency</th>
<th>LEA, n (%)</th>
<th>SpEd, n (%)</th>
<th>Total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>202.03</td>
<td>4.37</td>
<td>130.33</td>
<td>3.02</td>
<td>0.09</td>
<td>1.15</td>
<td>81 (40)</td>
</tr>
<tr>
<td>Low</td>
<td>186.15</td>
<td>3.08</td>
<td>175.62</td>
<td>2.11</td>
<td>0.06</td>
<td>1.12</td>
<td>121 (60)</td>
</tr>
</tbody>
</table>

Fit Information for LCGA Models

<table>
<thead>
<tr>
<th>Model</th>
<th>AIC</th>
<th>BIC</th>
<th>ABIC</th>
<th>MCMC p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Class</td>
<td>3389.70  14329.19  1391.38  202  000</td>
<td>13904.70  15185.15  13911.28  201  000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
Kurtosis model fit the data best and had a slightly higher reliability estimate
• Perhaps a benefit of the residual variances freed across the time points
• Parallel process model had the lowest reliability estimate
• Model had poorer fit information and criteria
• Perhaps because of model constraints (e.g., no correlation between InterceptA-B and SlopeA-B)
• Very low reliability estimates across all methods
• Assumption of linear growth was not adequate
• Research shows that within-year fluency growth is non-linear (Christ et al., 2010; Nese et al., in press, no data)
• Future research to explore methods to estimate the reliability of non-linear growth

Latent Class Growth Analyses

• Moving from a 2-Class to an 8-Class model classified students only on intercept, not on slope
• Did not encounter intersecting slopes among classes
• High-intercept class(es) exhibited linear or no growth
• Low-intercept class(es) exhibited cubic growth
• Low class(es) included all LEP, most SpEd students
• Future research to look at developmental trends in growth and classes across grades and explore differences in High- and Low-intercept classes (e.g., linear vs. cubic growth)
• Future research to consider how Tier 1, Tier 2, and Tier 3 instruction affect growth

References


For further information

Please contact Joe Nese nese@uoregon.edu More information on this and related projects can be obtained at http://nese.oregon.edu

Funding Source

This project was funded through the National Center on Assessment and Accountability for Special Education (NCASE) grant (R324C110004) from the U.S. Department of Education, Institute of Education Sciences. Opinions expressed do not necessarily reflect the opinions or policies of the U.S. Department of Education.