Modeling Reading Growth in Grades 3-5 with the Oregon Alternate Assessment

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Purpose

• The purpose of this study was to model reading growth for Students with Significant Cognitive Disabilities (SWSCDs), particularly for students with different disability eligibilities.

• Determining how to address missingness was another critical dimension for our study.
Research Questions

1. What is the typical growth trajectory for SWSCDs in reading across Grades 3-5 in Oregon?
2. How do SWSCDs growth trajectories vary between students around the typical growth trajectory?
3. Do students with different disability classifications progress at significantly different rates?
## Study Sample

- 1,464 Oregon students
- Participated in the Oregon AA-AAS Reading assessment in 2011, 2012, and/or 2013
- Typical grade level progressions

- 68.6% Male
- 81.4% White
- 16.3% with an ID
- 18.9% with ASD
- 19.9% with CD
- 14.3% with OHI
- 30.6% with SLD
Oregon Reading AA-AAS

• One, grade-banded assessment (G3-5), with a common scale across all three years
• Scale is centered on 100 (range is typically between 60-140)
• Reliability:
  – Internal consistency of measures was quite high: Cronbach’s $\alpha = .92, .95,$ and $.96$ for 2011, 2012, and 2013, respectively (ODE)
• Validity:
  – Documentation framed by the work of Messick, with construct validity as the overall framework (ODE)
Study Methods

• Nonlinear latent growth curve model with an estimated factor score (Kamata, Nese, Patarapichayatham, & Lai, 2013)
  – Growth appeared to decelerate
• MLR estimation with robust standard errors (MLR) through Mplus
• Effect sizes for the average growth between time points were computed (Bloom, Hill, Black, & Lipsey, 2008)
Missing Data

• Missing data
  – Failed Little’s Missing Completely at Random (MCAR) test with the MissMech R software package (Jamshidian, Jalal, & Jansen, 2014)

• We thus used a random-effects pattern-mixture model to account for missingness in the data (Enders, 2011)
### Patterns of Missingness

<table>
<thead>
<tr>
<th>Pattern</th>
<th>2010-11</th>
<th>2011-12</th>
<th>2012-13</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>114</td>
</tr>
<tr>
<td>2*</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>113</td>
</tr>
<tr>
<td>3*</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>263</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>212</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>127</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>48</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>587</td>
</tr>
</tbody>
</table>

*Note. A zero indicates that the student did not participate in the AA-AAS that year, while a one indicates the student did participate.

*Groups were collapsed prior to analysis.*

Only 40% of sample has no missing data
Study Results

• Three models
  – Model 1: Unconditional
  – Model 2: Including static disability predictors
  – Model 3: Pattern-mixture model, including static disability predictors and missingness patterns

• Model fit evaluated with SRMR, CFI, and RMSEA \((\text{Hu & Bentler, 1999; Kline, 2013})\)

• Competing models evaluated with AIC and BIC \((\text{Akaike, 1973; Schwarz, 1978})\)
SEM Model 3

Observed variables

Correlated Latent Intercept & Slope

Patterns of missingness

Direct Effects

Disability Predictors

ID  CD  ASD  OHI  SLD  Missing
### Model Parameter Estimates

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Disability-conditional model</th>
<th>Pattern-mixture model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>SE</td>
</tr>
<tr>
<td>Intercept (ID)</td>
<td>96.57*</td>
<td>1.19</td>
</tr>
<tr>
<td>CD</td>
<td>13.97*</td>
<td>1.34</td>
</tr>
<tr>
<td>ASD</td>
<td>-1.82</td>
<td>1.80</td>
</tr>
<tr>
<td>OHI</td>
<td>10.11*</td>
<td>1.79</td>
</tr>
<tr>
<td>SLD</td>
<td>17.50*</td>
<td>1.28</td>
</tr>
<tr>
<td>Miss G3</td>
<td>2.32</td>
<td></td>
</tr>
<tr>
<td>Miss G4</td>
<td>-2.28*</td>
<td>0.83</td>
</tr>
<tr>
<td>Miss G5</td>
<td>0.96</td>
<td>1.08</td>
</tr>
<tr>
<td>Miss two years</td>
<td>-1.10</td>
<td>1.05</td>
</tr>
<tr>
<td>Slope (ID)</td>
<td>-1.89*</td>
<td>0.83</td>
</tr>
<tr>
<td>Miss G3</td>
<td>1.85</td>
<td></td>
</tr>
<tr>
<td>Miss G4</td>
<td>-2.28*</td>
<td></td>
</tr>
<tr>
<td>Miss G5</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Miss two years</td>
<td>1.76</td>
<td></td>
</tr>
<tr>
<td>Variance comp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>231.95</td>
<td>15.23</td>
</tr>
<tr>
<td>Slope</td>
<td>66.76</td>
<td>8.17</td>
</tr>
<tr>
<td>Residual 2011</td>
<td>1.73</td>
<td>1.32</td>
</tr>
<tr>
<td>Residual 2012</td>
<td>67.94</td>
<td>8.24</td>
</tr>
<tr>
<td>Residual 2013</td>
<td>12.60</td>
<td>3.55</td>
</tr>
</tbody>
</table>

*Note. ID = Intellectual Disability. CD = Communication Disorder. OHI = Other Health Impairment. ASD = Autism Spectrum Disorder. SLD = Specific Learning Disability. Miss G3, G4 and G5 = students who were missing a time point, respectively. Miss two years = students with two missing time points. p < .05

The variance around the slope estimates is higher than the estimate, suggesting wide variation in slope estimates.

Only students missing G5 had significant growth differences based on missingness.

Significant intercept differences across all disability categories except for ASD (all higher than reference group).

Significant slope differences for CD and SLD (negative); ASD & OHI indistinguishable from reference group.

Only students missing G4 or 5 had significant intercept differences based on missingness.
Students with ID and no missing data were our reference group.
### Growth Effect Sizes

<table>
<thead>
<tr>
<th>Variable</th>
<th>Grade 3 to 4</th>
<th>Grade 4 to 5</th>
<th>Grade 3 to 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>0.53</td>
<td>0.15</td>
<td>0.75</td>
</tr>
<tr>
<td>ASD</td>
<td>0.39</td>
<td>0.32</td>
<td>0.74</td>
</tr>
<tr>
<td>OHI</td>
<td>0.45</td>
<td>0.09</td>
<td>0.58</td>
</tr>
<tr>
<td>SLD</td>
<td>0.51</td>
<td>0.06</td>
<td>0.66</td>
</tr>
<tr>
<td>CD</td>
<td>0.53</td>
<td>-0.06</td>
<td>0.46</td>
</tr>
</tbody>
</table>

*Note.* ID = Intellectual Disability; ASD = Autism Spectrum Disorder; OHI = Other Health Impairment; SLD = Specific Learning Disability; CD = Communication Disorder.

ASD results do not appear to be nonlinear, though peers do.
Means Missingness Patterns

Figure 2. Means across the three test occasions (2011, 2012, and 2013) for students who took the Oregon AA-AAS, by missing data pattern.
Limitations

• Interpretation of the missingness patterns was difficult, suggesting the possibility of an omitted variable
• Modeling assumed that growth deceleration was consistent across all groups, but this was clearly not the case for students with ASD
• Results may not generalize outside of our sample
Conclusion & Discussion

- SWSCDs are growing in reading across grades 3-5 in Oregon
- Growth was substantially nonlinear, except for students with ASD
- Missing data are pervasive and worthy of future research
References


Thank You!

• Dan Farley, Behavioral Research & Teaching
  – Please email me if you would like a complete copy of the paper.
  – dfarley@uoregon.edu
RQ Answers

• **RQ1**: The typical growth trajectory ranges from effect sizes of .46 (CD) to .75 (ID).

• **RQ2**: Slope variance is estimated as 7.59 RIT score points (whereas the actual slope estimate for model 3 was 5.67).

• **RQ3**: Growth trajectories for ID and ASD students were significantly higher - pattern is low intercept is related to higher growth/high intercept is related to lower growth.