CBMs and Postsecondary Students with Developmental Disabilities: Examining Technical Adequacy

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April 10, 2014

Benefits of College
• Higher pay
  – $55,700 vs. $33,800
• Lower unemployment rates
  – 2.6 times higher for age 20-24 with HS diploma
• Not just financial
  – Better health, community participation, independence, self-esteem

(Baum, Ma, & Payea, 2010)

Postsecondary Opportunities for Students with DD
• Less likely than non-disabled peers to:
  – enroll in postsecondary programs
  – gain employment
  – remain employed

(Wagner, Newman, Cameto, Garza, & Levine, 2005)
Postsecondary Opportunities for Students with DD

• 73% higher weekly income for students with DD who complete a postsecondary program

(Migliore, Butterworth, & Hart, 2009)

Increasing Opportunities

• Emphasis on transition planning
  – 4 out of 5 HS students with disabilities (Cameto, Levine, & Wagner, 2004)
• Over 200 programs in US and Canada (Think College, 2014)
• Traditional degree, certificate programs, other alternative plans (Pampay & Bambara, 2012)

Academic Focus

• Research demonstrating the continued need for academic interventions (e.g., Hua et al., 2012; Woods-Groves et al., 2012)
• Sensitive measures of performance and progress
• Formative use of data (Hosp, 2011)
Curriculum-Based Measurement (CBM)

- Developed from Institute for Research on Learning Disabilities at the University of Minnesota
- Reading, written expression, spelling, mathematics
- Dynamic indicators of basic skills (DIBS) (Shinn, 1989)
- Designed to use in making instructional decisions (Hintze & Silbergliit, 2005)

Purpose

- What is the technical adequacy of CBM with postsecondary students with intellectual disabilities?
- Does grade level of passage impact reading rate? Prediction? Preference?

Method
Participants

- 45 postsecondary students
- Cognitive/intellectual disabilities
- 37.8% female (n = 17)
- 95.6% white (n = 43)
- Ages 18–25 yrs.
- Enrolled in the Realizing Education and Career Hopes program at The University of Iowa (UI REACH)

UI REACH – 2 yr. certificate program

- Includes: courses, campus life, career prep, post-grad support

Instruments

- CBMs used were part of the AIMSWeb suite (Pearson Education, 2012)
- 2nd, 4th, and 6th grade reading materials
- 5th grade math materials
Emailed Katelyn and Jo to see if there is a particular photo or graphic representation that they would prefer we use with the description of the program.

Kiersten, 3/22/2013
Instruments- CBM

Oral Reading Fluency (ORF)
- Words read correctly and errors
- Validity .60 to .80; Reliability .82-.99 (Reschly, Busch, Betts, Deno, & Long, 2009)

Maze
- Correct restorations and errors
- Validity .60-.86; Reliability .68-.90 (Wayman, Wallace, Wiley, Ticha, & Espin, 2007)

Math Computation (M-COMP)
- Correct digits and correct problems
- Reliability .83-.93 (Foegen, Jiban, & Deno, 2007)

Math Concepts and Application (M-CAP)
- Correct problems and points
- Reliability .80-.88 (Pearson Assessment, 2009)

Instrument – Criterion

Woodcock-Johnson III Tests of Achievement (WJIII; Woodcock, McGrew, & Mather, 2001)
- Broad Reading:
  - Letter Word Identification
  - Reading Fluency
  - Passage Comprehension
- Broad Math:
  - Calculation
  - Math Fluency
  - Applied Problems
Procedures
• Standardized procedures
• CBM measures administered during regularly scheduled class time within one week
• WJIII data collected by REACH staff within the past year

Data Analysis
• Two stages for technical adequacy
  – Descriptive statistics on each metric
  – Bivariate correlations between each CBM and content-appropriate criterion measure (both cluster and individual)
    • Meng’s z to compare correlations to determine better predictors

Data Analysis
• Two stages for examining grade level of passage
  – One-way ANOVA to determine if WRC differed given order the passage was read
  – General Linear Modeling to determine if differences existed in WRC given grade level of passage
Data Analysis

- Examining student self-report of favorite passage

Results

Descriptive Statistics

### Reading CBM

<table>
<thead>
<tr>
<th>Grade 2 OPR</th>
<th>Score</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPR</td>
<td>135.38</td>
<td>47.01</td>
<td>-0.30</td>
<td>-0.70</td>
</tr>
<tr>
<td>WRC</td>
<td>3.49</td>
<td>5.05</td>
<td>2.38</td>
<td>6.29</td>
</tr>
<tr>
<td>Grade 4 OPR</td>
<td>Score</td>
<td>SD</td>
<td>Skewness</td>
<td>Kurtosis</td>
</tr>
<tr>
<td>OPR</td>
<td>130.80</td>
<td>54.93</td>
<td>0.99</td>
<td>3.56</td>
</tr>
<tr>
<td>WRC</td>
<td>3.42</td>
<td>4.80</td>
<td>2.88</td>
<td>10.75</td>
</tr>
<tr>
<td>Grade 6 OPR</td>
<td>Score</td>
<td>SD</td>
<td>Skewness</td>
<td>Kurtosis</td>
</tr>
<tr>
<td>OPR</td>
<td>134.78</td>
<td>48.78</td>
<td>-0.35</td>
<td>-0.46</td>
</tr>
<tr>
<td>WRC</td>
<td>3.51</td>
<td>4.28</td>
<td>2.14</td>
<td>4.84</td>
</tr>
<tr>
<td>Maze CR</td>
<td>Score</td>
<td>SD</td>
<td>Skewness</td>
<td>Kurtosis</td>
</tr>
<tr>
<td>OPR</td>
<td>15.58</td>
<td>10.58</td>
<td>0.92</td>
<td>0.56</td>
</tr>
<tr>
<td>WRC</td>
<td>2.33</td>
<td>3.40</td>
<td>3.16</td>
<td>11.01</td>
</tr>
<tr>
<td>M-COMP CD</td>
<td>Score</td>
<td>SD</td>
<td>Skewness</td>
<td>Kurtosis</td>
</tr>
<tr>
<td>OPR</td>
<td>24.60</td>
<td>15.89</td>
<td>0.48</td>
<td>-0.16</td>
</tr>
<tr>
<td>WRC</td>
<td>7.82</td>
<td>5.97</td>
<td>0.85</td>
<td>1.62</td>
</tr>
<tr>
<td>M-CAP CP</td>
<td>Score</td>
<td>SD</td>
<td>Skewness</td>
<td>Kurtosis</td>
</tr>
<tr>
<td>OPR</td>
<td>5.33</td>
<td>5.07</td>
<td>0.70</td>
<td>0.21</td>
</tr>
<tr>
<td>WRC</td>
<td>1.88</td>
<td>1.38</td>
<td>2.51</td>
<td>8.56</td>
</tr>
</tbody>
</table>

Note: n = 45. OPR = oral passage reading; WRC = Words Read Correct; CR = Correct Restorations; M-COMP = Math Computation; M-CAP = Math Concepts & Applications CD = Correct Digits, CP = Correct Problems, Pts. = Points.
## Math CBM

<table>
<thead>
<tr>
<th>Measure</th>
<th>Metric</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-COMP</td>
<td>CP</td>
<td>24.50</td>
<td>15.89</td>
<td>0.48</td>
<td>-0.16</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>7.82</td>
<td>5.97</td>
<td>0.85</td>
<td>1.62</td>
</tr>
<tr>
<td>M-CAP</td>
<td>CP</td>
<td>5.33</td>
<td>4.04</td>
<td>0.73</td>
<td>0.21</td>
</tr>
<tr>
<td>Pts.</td>
<td></td>
<td>5.84</td>
<td>3.67</td>
<td>1.60</td>
<td>2.31</td>
</tr>
</tbody>
</table>

Note: M-COMP = Math Computation; M-CAP = Math Concepts & Applications; CP = Correct Digits; CP = Correct Problems; Pts. = Points.

## Criterion--WJIII

<table>
<thead>
<tr>
<th>Measure</th>
<th>Task</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>WJIII</td>
<td>Read Reading</td>
<td>76.53</td>
<td>16.68</td>
<td>-0.75</td>
<td>1.35</td>
</tr>
<tr>
<td></td>
<td>Letter Word ID</td>
<td>80.82</td>
<td>16.47</td>
<td>-0.74</td>
<td>1.75</td>
</tr>
<tr>
<td></td>
<td>Passage Comprehension</td>
<td>80.20</td>
<td>17.45</td>
<td>-0.47</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Read Math</td>
<td>63.62</td>
<td>21.92</td>
<td>-0.53</td>
<td>0.45</td>
</tr>
<tr>
<td></td>
<td>Calculation</td>
<td>68.82</td>
<td>20.99</td>
<td>-0.43</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>Math Fluency</td>
<td>65.00</td>
<td>18.05</td>
<td>0.04</td>
<td>-0.55</td>
</tr>
<tr>
<td></td>
<td>Applied Problems</td>
<td>71.00</td>
<td>16.30</td>
<td>-0.83</td>
<td>-0.41</td>
</tr>
</tbody>
</table>

Note: WJIII = Woodcock Johnson Tests of Academic Achievement; ID = Identification.

## Results

Correlations
### CBMs

**Correlations between CBMs**

<table>
<thead>
<tr>
<th>CBM Measure</th>
<th>Grade 2 OPR</th>
<th>Grade 4 OPR</th>
<th>Grade 6 OPR</th>
<th>Maze</th>
<th>M-COMP CD</th>
<th>M-COMP CP</th>
<th>M-CAP CP</th>
<th>M-CAP Pts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM Measure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 2 OPR</td>
<td>1.00</td>
<td>.882</td>
<td>.965</td>
<td>.773</td>
<td>.500</td>
<td>.484</td>
<td>.673</td>
<td>.641</td>
</tr>
<tr>
<td>Grade 4 OPR</td>
<td>1.00</td>
<td>.641</td>
<td>.763</td>
<td>.524</td>
<td>.530</td>
<td>.552</td>
<td>.565</td>
<td></td>
</tr>
<tr>
<td>Grade 6 OPR</td>
<td>1.00</td>
<td>.484</td>
<td>.448</td>
<td>.530</td>
<td>.552</td>
<td>.556</td>
<td>.565</td>
<td></td>
</tr>
<tr>
<td>Maze</td>
<td>1.00</td>
<td>.961</td>
<td>.884</td>
<td>.766</td>
<td>.757</td>
<td>.773</td>
<td>.779</td>
<td></td>
</tr>
<tr>
<td>M-COMP CD</td>
<td>1.00</td>
<td>.961</td>
<td>.884</td>
<td>.757</td>
<td>.773</td>
<td>.779</td>
<td>.779</td>
<td></td>
</tr>
<tr>
<td>M-COMP CP</td>
<td>1.00</td>
<td>.960</td>
<td>.884</td>
<td>.757</td>
<td>.773</td>
<td>.779</td>
<td>.779</td>
<td></td>
</tr>
<tr>
<td>M-CAP CP</td>
<td>1.00</td>
<td>.767</td>
<td>.696</td>
<td>.696</td>
<td>.696</td>
<td>.696</td>
<td>.696</td>
<td></td>
</tr>
<tr>
<td>M-CAP Pts.</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* n = 45. OPR = Oral Passage Reading; M-COMP = Math Computation; M-CAP = Math Concepts & Applications; CD = Correct Digits; CP = Correct Problems; Pts. = Points.

### Reading

**Correlations between Reading CBMs and Criterion Measure**

<table>
<thead>
<tr>
<th>CBM Measure</th>
<th>WJIII Broad Reading</th>
<th>WJIII Letter Word ID</th>
<th>WJIII Reading Fluency</th>
<th>WJIII Passage Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 2 OPR</td>
<td>-.811 (p &lt; .05)</td>
<td>-.820 (p &lt; .05)</td>
<td>-.693 (p &lt; .05)</td>
<td>-.532 (p &lt; .05)</td>
</tr>
<tr>
<td>Grade 4 OPR</td>
<td>-.724 (p &lt; .05)</td>
<td>-.712 (p &lt; .05)</td>
<td>-.669 (p &lt; .05)</td>
<td>-.524 (p &lt; .05)</td>
</tr>
<tr>
<td>Grade 6 OPR</td>
<td>-.846 (p &lt; .05)</td>
<td>-.831 (p &lt; .05)</td>
<td>-.760 (p &lt; .05)</td>
<td>-.661 (p &lt; .05)</td>
</tr>
<tr>
<td>Maze</td>
<td>-.762 (p &lt; .05)</td>
<td>-.717 (p &lt; .05)</td>
<td>-.723 (p &lt; .05)</td>
<td>-.612 (p &lt; .05)</td>
</tr>
</tbody>
</table>

*Note.* n = 45. WJIII = Woodcock Johnson Tests of Academic Achievement-Third Edition; OPR = Oral Passage Reading; ID = Identification.

### Reading (continued)

**Comparison between Correlations of Reading CBMs and Criterion Measure, Meng's z**

<table>
<thead>
<tr>
<th>CBM Measure</th>
<th>Grade 2 OPR to Grade 4 OPR</th>
<th>Grade 2 OPR to Grade 6 OPR</th>
<th>Grade 2 OPR to Maze</th>
<th>Grade 4 OPR to Grade 6 OPR</th>
<th>Grade 4 OPR to Maze</th>
<th>Grade 6 OPR to Maze</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>-0.142</td>
<td>-1.771*</td>
<td>-1.429</td>
<td>-1.771*</td>
<td>-1.588*</td>
<td>2.319**</td>
</tr>
<tr>
<td>p-value</td>
<td>.862</td>
<td>.980</td>
<td>.094</td>
<td>.980</td>
<td>.980</td>
<td>.048</td>
</tr>
</tbody>
</table>

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## Math

### Correlations between Math CBMs and Criterion Measures

<table>
<thead>
<tr>
<th>CBM Measure</th>
<th>WJIII Math Calculation</th>
<th>WJIII Math Fluency</th>
<th>WJIII Applied Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-COMP CD</td>
<td>0.751 (.001)</td>
<td>0.715 (.001)</td>
<td>0.802 (.001)</td>
</tr>
<tr>
<td>M-COMP CP</td>
<td>0.783 (.001)</td>
<td>0.742 (.001)</td>
<td>0.657 (.001)</td>
</tr>
<tr>
<td>M-CAP CP</td>
<td>0.761 (.001)</td>
<td>0.721 (.001)</td>
<td>0.601 (.001)</td>
</tr>
</tbody>
</table>


### Math (continued)

#### Correlations between Math CBMs and Criterion Measures (continued)

<table>
<thead>
<tr>
<th>CBM Measure</th>
<th>WJIII Math Calculation</th>
<th>WJIII Math Fluency</th>
<th>WJIII Applied Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-COMP CD  to M-COMP CP</td>
<td>-0.600</td>
<td>-0.422</td>
<td>-0.961</td>
</tr>
<tr>
<td>M-COMP CD to M-CAP CP</td>
<td>0.710</td>
<td>0.761</td>
<td>1.500</td>
</tr>
<tr>
<td>M-COMP CP to M-CAP CP</td>
<td>0.838</td>
<td>0.837</td>
<td>1.275</td>
</tr>
<tr>
<td>M-CAP CP to M-CAP Pts.</td>
<td>0.675</td>
<td>0.670</td>
<td>1.080</td>
</tr>
</tbody>
</table>

**Note.** n = 45. WJIII = Woodcock Johnson Tests of Academic Achievement-Third Edition; M-COMP = Math Computation; M-CAP = Math Concepts & Applications; CD = Correct Digits, CP = Correct Problems, Pts. = Points; *p < .1; **p < .05; ***p < .01.

### Results

**Repeated Measures ANOVA**
Results

Preference

There was not a significant effect for difficulty level of reading passages, Wilks’ Lambda = .969, F (2, 43) = .689, p = .507.

Effect of Passage Difficulty Level on OPR Rate

Reading CBM

Number of Students Selecting as Favorite

0 5 10 15 20 25
Second Fourth Sixth

Grade Level of Passage

Grade Level of Passage

Words Read Correct

Grade 2 Grade 4 Grade 6
Findings—Technical Adequacy

• Similar to previous study (Hosp, Ford, Hensley, & Huddle, in review)
• Better prediction of Passage Comprehension (.36/.57 to .55/.61)
• OPR & Maze no changes in differential prediction

Findings—Technical Adequacy

• M-COMP better prediction
  – Broad Math (.67/.69 to .80/.81)
  – Applied Problems (.39/.46 to .70/.71)
• M-COMP & M-CAP differences for Applied Problems not present

Findings—Grade Level of Passage

• Reading Rate
  – No differences
• Prediction
  – Grade 6 seemed best overall
    • > Grade 4 for Broad Reading, Letter-Word ID, and Passage Comprehension
    • > Grade 2 for Reading Fluency
    • > Maze for Letter-Word ID
• Preference
  – Grade 4
Limitations

• Sample not nationally representative or random
• Relatively small sample size
• Use of single probe/passage

Conclusions

• Increasing number of students with ID entering postsecondary programs
• Continuing need for academic focus
• Appropriate tools for this population
• Higher grade level of reading material offers slightly better overall prediction