Hypotheses:
- Spelling development of cognitively impaired spellers will differ from that of typically developing, age-matched peers.
- There will be a shift from reliance on early developing components to more advanced spelling components with age.

Subjects
- 47 children (26 males and 21 females)
  - 11 classified as Mild Cognitively Impaired (MCI)
  - 36 classified as typically developing (TD)

Materials
- Wide Range Achievement Test, fourth edition (WRAT-4; Wilkinson & Robertson, 2006) - assessed phonological knowledge & visual accuracy via spelling test format
- Orthographic task - form with 10 nonword pairs listed
  - *e.g.* *ffeb, beff*
- Morphological task - form containing 8 sentences
  - *e.g.* *Today the boy reaches for the toy. What is he doing right now? Right now he is ____ for the toy.*
Procedures

• MCI tested in 2 individual sessions
• TD tested in 1 individual session
• Spelling subtest of the WRAT – Administered Part 1 which involved writing letters, Part 2 involved spelling words
• Orthographic - Circled 1 of the 2 nonwords in each pair that was consider most likely to be a real word
  e.g. ffeb, beff
• Morphological - Completed sentences by spelling words containing -ed or –ing
  e.g. Today the boy reaches for the toy. What is he doing right now? Right now he is reaching for the toy.
Scoring

• WRAT Scoring: Combined spelling score was derived
  – Raw scores from Parts 1 and 2 were combined
  – Divided by 36 (the total # of possible points)
  – Answer multiplied by 100 for a percentage score
• Phonological Scoring: Bruck and Waters scoring system (as cited in Lennox & Siegel, 1996)
  – Used responses from Part 2 of the WRAT
  – Scored how similar error was to actual sound of target word
  – Example: target word = circle
    acceptable deviation = serkl
    non-phonological deviation = cokel
  – Phonological score = % of misspellings that were phonologically accurate deviations of the target word
Scoring

• Visual Similarity
  – Based on Part 2 of the WRAT
  – Visual Similarity = % of bigrams shared between the misspelling and the target word
  – Reach = 4 bigrams + 5 letters = 9
    • Misspelling rech = 2 correct bigrams + 4 correct letters = 6
    • Obtained total score for the misspelled word/total possible = 6/9 = .67 X 100 = 67%

• Orthographic and Morphological
  – Based on point scale
  – 1= correct , 0= incorrect
  – Percent correct was derived for both orthographic and morphological tasks
Mean and SD Comparison of Spelling on WRAT

<table>
<thead>
<tr>
<th>Combined Grade Level</th>
<th>TD Mean</th>
<th>TD SD</th>
<th>MCI Mean</th>
<th>MCI SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>50.25</td>
<td>5.85</td>
<td>42.25</td>
<td>5.62</td>
</tr>
<tr>
<td>3 &amp; 4</td>
<td>61.44</td>
<td>6.17</td>
<td>46.8</td>
<td>6.34</td>
</tr>
<tr>
<td>5 &amp; 6</td>
<td>68.64</td>
<td>8.39</td>
<td>44.5</td>
<td>12.02</td>
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</tbody>
</table>
Spelling Results on the WRAT

- Two-Way Analysis of Variance for a 2 (classification) x 3 (grade) between group design
  - **significant main effects** for grade and classification on the spelling assessment section of the WRAT
  - TD children performing better than MCI children, $F(1,41)=38.601$, $p<.001$
  - older children performing better than younger children, $F(2,41)=6.430$, $p=.004$

- One-Way ANOVA revealed a **significant main effect of grade level for the TD group**, $F(2,33)=22.326$, $p<.001$, but not for the MCI group, $F(2,8)=.461$, $p=.646$
  - For the TD, Tukey Post-Hoc tests revealed significant differences between grades 1 and 2 as compared to grades 3 and 4, $p=.001$ and grades 1 and 2 as compared to grades 5 and 6, $p<.001$
Mean Percentage Scores for Spelling Performance Measures

TD Mean Percentage Scores for Spelling Performance Measures

MCI Mean Percentage Scores for Spelling Performance Measures
Significant Main Effects

• 3 x 3 x 2 ANOVA for a mixed design [1 within subjects factor (spelling performance measures) and two between subjects factors (grade and classification – TD vs. MCI) ]
  – **significant main effect of the spelling performance measures**: $F(2, 82)=74.446, p<.001$
  – **significant main effect of grade**:  
    $F(2, 41)=5.037, p=.011$
  – **significant main effect of classification**:  
    $F(1, 41)=37.163, p<.001$
  – 1 significant interaction between the spelling performance measures and classification $F(2, 82)=9.363, p<.001$
Visual Similarity Scores for TD and MCI Children

Mean Visual Similarity Scores for TD and MCI children

Results for Visual Similarity Scores

- 3 x 2 ANOVA investigating effect of grade and classification on the visual similarity scores
  - significant main effects for: grade,
    \[ F(2, 41) = 3.592, \ p = .037, \]
    \[ and \ classification, \]
    \[ F(1, 41) = 41.6, \ p < .001 \]
  - no significant interaction: \[ F(2, 41) = 1.407, \ p = .256 \]
Conclusions

• Results consistent with past research that show a difference in the spelling abilities of TD children and children with disabilities.

• MCI children performed significantly below the levels observed in TD children across all grade levels.

• By the 3rd and 4th grade level, TD children evidenced mastery of both the orthographic and morphological skills. Phonological skills continued to improve with grade level.

• Results do not indicate that “earlier developing” skills are being replaced by more advanced skills as previous research suggests (Reece & Treiman, 2001). However, there is a developmental trend.

• MCI children did not begin to develop significant spelling abilities until the 3rd and 4th grade level.

• MCI are not using phonological knowledge until the 5th and 6th grade level.

• Overall, ability to visually represent words did not change across grade levels. Thus, the MCI have difficulty knowing what the target words should look like.

• MCI children are not relying on their visual storage abilities when other spelling measures are underdeveloped as was previously suggested by Lennox & Siegel (1996).
Bottom Line...

- As predicted, the MCI children showed a different pattern of development. On all measures, the performance of the MCI children was below that of the TD children.
- MCI students had difficulty spelling but the older students are beginning to use more strategies in an attempt to spell.
- This suggests a delay in MCI children’s ability to integrate the components of spelling.
References


