**Effect of Training Type On Learning to Read Novel Orthography**

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**BACKGROUND**

Most adults learn to read as children with relative ease and can briefly skim a paragraph and quickly grasp its meaning. However, anecdotal evidence both from educated individuals as well as illiterate adults in underprivileged countries suggests that it is impossible to achieve the same fluency as an adult. (Iyer et al., 2017) Adults learning to read in a new orthography are “re-taught” in a struggling state. They never achieve the ability to skim a paragraph and instead, must read every word letter-by-letter. Since this has never been tested in a lab setting, we do not know whether this inability to read fluently in a new orthography is due to a change in learning capability with age, or if this has to do with how the new orthography is taught. This study trained TCU students to recognize letter-to-sound correspondences in Hebrew using either an in-person tutor or a pre-recorded program.

**AIMS OF STUDY**

- Evaluate whether there is a difference between tutor group and automated training programs in both areas of letter recognition and fluency.
- To evaluate the best steps on moving forward on future research.

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**RESULTS**

**SUMMARY OF PARTICIPANT CHARACTERISTICS**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
<tr>
<td># Female</td>
<td>7</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>KBIT</td>
<td>101.00</td>
<td>10.38</td>
<td>111.73</td>
</tr>
<tr>
<td>SWE</td>
<td>100.00</td>
<td>12.83</td>
<td>94.38</td>
</tr>
<tr>
<td>POE</td>
<td>107.56</td>
<td>23.23</td>
<td>96.63</td>
</tr>
<tr>
<td>WID</td>
<td>106.54</td>
<td>6.44</td>
<td>94.63</td>
</tr>
<tr>
<td>WA</td>
<td>102.78</td>
<td>11.45</td>
<td>92.38</td>
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<tr>
<td>PC</td>
<td>106.00</td>
<td>8.08</td>
<td>107.00</td>
</tr>
<tr>
<td>Ran-L</td>
<td>11.33</td>
<td>2.00</td>
<td>10.38</td>
</tr>
<tr>
<td>RWAML-DAM</td>
<td>11.89</td>
<td>2.32</td>
<td>10.13</td>
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<tr>
<td>WRAML-DMR</td>
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<td>4.27</td>
<td>10.00</td>
</tr>
<tr>
<td>WRAML-NCL</td>
<td>12.33</td>
<td>1.73</td>
<td>11.13</td>
</tr>
</tbody>
</table>

All groups quickly and accurately learned to recognize letter symbols in Hebrew. There was no difference in performance between the automation and tutoring condition. Two-tailed, unpaired t-tests revealed no significant differences between the automation and tutoring groups at any time point (all p-values > 0.08).

Many studies of novel orthography learning only report letter ID scores as a metric of learning, but reading ability is more than letter identification. We therefore included measures of automaticity and fluency to evaluate the depth of learning achieved by our program.

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**METHODS**

**PARTICIPANT GROUPS (all between 18-23 yr old):**

1. Automated (N = 8)
2. Tutor (N = 8)

**Study Components:**

1. Assessment
2. Training
3. Follow-up/reiteration

**English Assessments:**

- KBIT: matrices (nonverbal IQ)
- TOWRE-2: Sight Word Efficiency; Pseudo Word Decoding Efficiency
- WRAML: Word ID; Word Attack; Passage Comprehension
- CTOPP:
  - Ran letters
  - WRAML:
    - Design Memory Core
    - Design Memory Recall
    - Number letter

**Training Lessons**

- Assessment
  - Nonverbal IQ
  - Reading
  - Attention
  - Working Memory
- Instructors
  - In-person: 4 well trained tutors
  - Automated: pre-recorded voice with instructions and feedback
- Course
  - Participants were introduced to 1-2 new characters per lesson (13 total)
  - No more than 3 days between lessons

**Hebrew assessment**

- Hebrew Letter ID (based on Letter ID test, WRAML-t3)
- Hebrew Ran (based on Ran subset of the CTOPP)
- Hebrew TOWRE (based on TOWRE-2 subset of pseudo word decoding efficiency)
- Hebrew TOWRE (based on TOWRE-2 subset of pseudo word decoding efficiency)
- Hebrew rapid automated naming
- Hebrew pseudoword decodifyng

**DISCUSSION / FUTURE DIRECTIONS**

- Our data show that automatic, computer-based instruction is as effective for letter-to-sound association training as an in-person tutor.
- Our study was over a relatively short time period so we do not know if this result generalizes to longer learning periods.
- High Letter-to-sound accuracy does not translate to high scores on automaticity and decoding measures.
- This is likely due to the short training time in our study.
- The pattern of results in our study validate Hebrew orthography learning as a model for dyslexia in a typically-reading population.
- We are currently using the automated training approach to test a novel intervention for dyslexia.
- Fluent English readers complete this training program while receiving low-level stimulation to the left auricular vagus nerve.
- Stimulation for the vagus nerve can drive neural plasticity in certain conditions and is beneficial for those suffering from tinnitus (Engineer et al., 2011) and stroke (Dawson et al., 2011).
- If successful, this approach may provide a new approach to intervention for children with dyslexia.

**Selected References**