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 this same fluency as an adult. (Royer et al., 2017) Adults learning to read in a new orthography are 'stuck' 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.

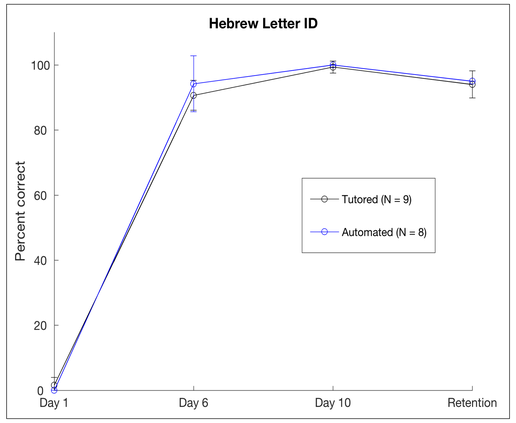
Aims of Study

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

RESULTS

Summary of participant characteristics

Measure	Tutor (N = 9)	Automated (N = 8)	P-values
# female	7	8	
KBIT	101.00 + 10.38	111.75 + 9.02	**0.04**
SWE	109.00 +12.83	94.38 +15.38	0.05
PDE	107.56+9.23	98.63+8.67	0.06
WID	106.56+8.44	94.63+24.91	0.32
WA	102.78+11.45	93.388.14	0.07
PC	106.00+8.08	107.00+6.12	0.11
RAN-L	11.33+2.00	10.38+2.13	0.14
RWRAML-DM	11.89+2.32	10.13+2.64	0.16
WRAML-DMR	10.22+4.27	10.00+2.78	0.90
WRAML-NL	12.33+1.73	11.13+2.85	0.30



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).

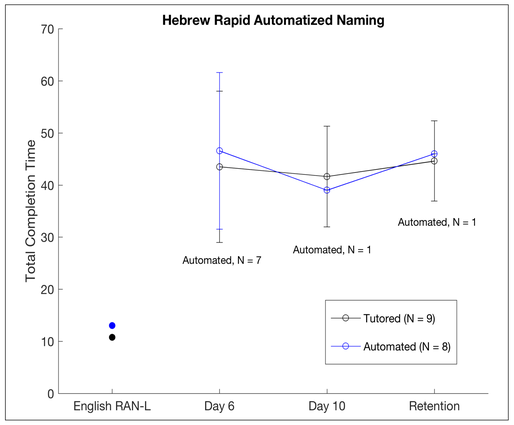
Many studies of novel orthography learning only report letter ID scores as a metric of learning, but reading ability is more than letter identification.

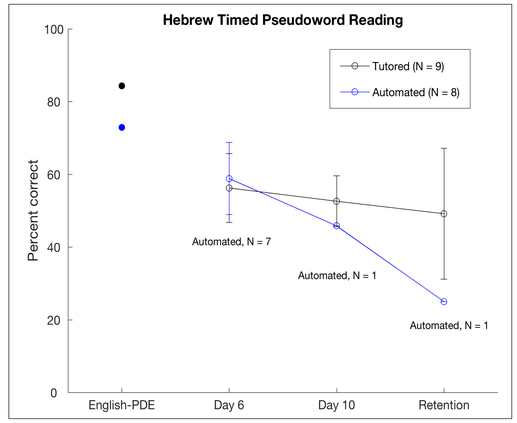
We therefore included measures of automaticity and fluency to evaluate the depth of learning achieved by our program.

Rapid Automatized Named (in English) is one of the strongest predictors of future reading success (Norton & Wolf, 2012). There was a significant group difference in raw scores in English (p = 0.01).

Regardless of training methods, participants were significantly slower in Hebrew than in English after 10 days of practice. The unpaired t-tests revealed no significant differences between the automation and tutoring groups at any time point (all p-values > 0.69).

Considering the age of our participants and their level of fluency in English, this is not surprising.





All participants were similarly unable to perform a pseudo word reading task after 10 days of training.

There was no difference in performance between the automation and tutoring condition. The unpaired t-tests revealed no significant differences between the automation and tutoring groups at any time point (all p-values > 0.28). On a comparable English measure, there was a significant group difference in raw scores in English (p = 0.02).

These findings demonstrate that orthography instruction is effective at teaching letter-sound correspondences, but does not provide the level of practice needed to achieve automaticity or fluency.

METHODS

Participant groups (all between 18-23 y/o):
1.Automated (N =8)
2. Tutored (N = 9)

Study components:
1.Assessment
2.Training
3.Follow-up/retention

English Assessments:
-KBIT
- matrices (nonverbal IQ)

-TOWRE-2
- Sight Word Efficiency
- Psuedo Word Decoding efficiency

-WRMT-3
- Word ID
- Word Attack
- Passage Comp

-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

-Training
- Participants were introduced to 1-2 new characters per lesson (13 total)
- No more than 3 days between lessons

Introduction

Character Practice

Word Like Practice

Hebrew assessment
- Hebrew Letter ID (based on Letter ID subtest, WRMT-3)
  - participants were instructed to sound out Hebrew letters on screen
- Hebrew RAN (based on RAN subtest of the CTOPP
  - participants were given a list of Hebrew consonant/vowel characters and told to sound them out as quickly and accurately as possible.
- Hebrew TOWRE (based on TOWRE-2 subtest of pseudo word decoding efficiency)
  - given 45 seconds to read a list of pseudo words in Hebrew as quickly and accurately as possibly

	Day 1	Day 6	Day 10	Retention
Hebrew Letter ID	X	X	X	X
Hebrew Rapid Automatized Naming		X	X	X
Hebrew Pseudoword Decoding		X	X	X

DISCUSSION / FUTURE DIRECTIONS

- Our data show that automate, 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., 2017)
  - If successful, this approach may provide a new approach to intervention for children with dyslexia.

Selected References

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