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Does ability to establish symbol-sound pairings mediate the RAN-reading relationship?

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Introduction

Ability to learn

Rapid naming (RAN) of letters and digits has been shown to correlate with reading. One possible reason for the RAN-reading correlation is that RAN taps the ability to learn and automatise symbol-sound associations (Manis et al., 1999). This possibility is not unlikely given that paired associate learning (PAL), just as RAN, has been shown to differentiate dyslexics from controls (Elbro & Jensen, 2005; Mayringer & Wimmer, 2000; Messbauer & de Jong, 2006), and to correlate with reading ability in unselected samples (Windfuhr & Snowling, 2001). However, PAL is usually conceived of as a measure of phonological ability, whereas RAN is often thought to measure "something else".

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• Research question 1: Does paired associate learning correlate with RAN or PA?

Opportunities for learning

Another possibility is that RAN still measures differences in automatisation of symbol-sound pairings, but that the RAN-reading relationship is explained by individual differences in learning *opportunity rather than learning ability.* It is possible that alphanumeric RAN measures home environment training of school relevant knowledge (e.g. familiarity with letters, numbers and reading). We address this issue by using PAL as a measure of ability to learn and preschool letter knowledge as a measure of preschool opportunities to learn.

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• Research question 2: Does either letter knowledge or PAL mediate the RAN-reading relationship?

RAN with letters and digits is more closely correlated with reading than RAN with objects. The reason may be that RAN letters and RAN digits tap the opportunities to acquire school relevant knowledge in the home environment. We address this issue in the final research question:

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• Research question 3: Does controlling for letter knowledge and nonalphanummeric RAN remove the correlation between alphanumeric RAN and reading?

Method

Participants

166 preschoolers were tested at the end of Grade 0 and we followed their reading development through the first half of Grade 1.

Dependent variables

Reading accuracy: Proportion words read correctly aloud out of 104 in January of Grade 1.

Reading efficiency: Number of words read correctly pr. minute in January of Grade 1.

Predictor variables

Preschool phoneme awareness: Phoneme deletion task.

Preschool RAN digits and objects: Correct pr. second

Preschool paired associate learning: Two separate tasks. The students had to learn the names of 3-4 doodle animals. The dependent measure was a composite of the number of trials spent learning to criterion in the two tasks. Criterion was three trials of correctly naming all animals.

Control measures

Visio-motor reaction time (RT): Timed cross-out task with letter-like symbols.

Nonverbal cognitive ability (CA): Ravens

Results: Control for RT and CA above the

	Reading efficiency	Reading accuracy	PAL	Letter knowledge	RAN-digits	RAN-objects	Phoneme awareness
Reading efficiency	-	.82**	.31**	.36**	.56**	.41**	.49**
Reading accuracy	.82**	-	.32**	.43**	.46**	.23**	.59**
PAL	.31**	.34**	-	.29**	1 .11	.08	.25**
Letter knowledge	.37**	.43**	.29**	-	2 .21**	.20**	.34**
RAN-digits	.55**	.46**	.1	.23**	-	.61**	.28**
RAN-objects	.41**	.23**	.08	.22**	.63**	-	.21**
Phoneme awareness	.50**	.59**	.27**	.34**	.28**	.22**	-
General RT	.06	.03	-.06	.11	.25**	.24**	.02
Cognitive ability	.09	.17*	.17*	.07	.10	.12	.12

Dynamic RAN

We also measured rapid naming performance with the items learned in the PAL tasks. Interpretation is made difficult because of low completion rate and low reliability. The impression is that this rapid naming task produces a lower correlation pattern than traditional RAN and PAL. Ask for more information

Results: Hierarchical regressions on reading

Step	Task	Reading efficiency R^2	Reading efficiency ΔR^2	Reading Accuracy R^2	Reading Accuracy ΔR^2
1	RAN-digits	.31	.31***	.21	.21***
	Control for PAL				
1	PAL	.10	.10***	.12	.12***
2	RAN-digits	.37	.28***	.30	.18***
	Control for letter knowledge				
1	Letter knowledge	.14	.14***	.19	.19***
2	RAN-digits	.37	.23***	.32	.13***

2

Step	Task	Reading efficiency R^2	Reading efficiency ΔR^2	Reading Acc R^2	Reading Acc ΔR^2
1	RAN-o, letter know, RT	.26	.26***	.23	.23***
2	RAN-digits	.38	.13***	.36	.13***

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Summary of results and discussion

1 RAN does not appear to measure ability to *learn* symbol-sound associations. Instead this ability appears to be more closely tied to phoneme awareness (contrary to Mayringer & Wimmer, 2000).

- Paired associate learning correlated significantly with phoneme awareness (r = .25), but not RAN. PAL did not mediate the RAN-reading relationship.

2 RAN does not appear to measure preschool *opportunities* for learning school relevant knowledge.

- Controlling for letter knowledge did not reduce RAN-reading correlation substantially.

3 RAN-digits' superior prediction of reading compared to RAN-objects does not rely on superior school knowledge

- RAN-digits predicted plenty unique variance after controlling for RAN-o and letter knowlege.

This leaves the question of why alphanummeric RAN is a better predictor of reading? One possibility is that RAN-digits has better internal reliability (.63) than of RAN-objects (.33) when measuring correlation between first and last line of RAN.