Visual Attention Span and Re-entrant Processing in Struggling Readers

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Objective

To gain deeper insight about visual attention span (VAS), object-substitution masking (OSM), and their relationship to reading ability in grade four children with reading difficulties (RD).

Research Questions

1. Does VAS impact reading ability in Grade Four children?
2. Does VAS have a relationship with OSM?
3. Does OSM have a relationship with reading ability?

Methods

Participants were Grade Four children recruited from the Winnipeg School Division (N = 37), with a mean age of 9.38 years. Teachers identified good and poor readers.

Session 1: TOWRE, WRMT, WASI, CTOPP

TOWRE: Test of Word Reading Efficiency
(Reading accuracy and speed standard score: Good > Poor readers)

WRMT: Woodcock Reading Mastery Test
(Word Identification: Good > Poor readers)

WASI: Wechsler Abbreviated Scale of Intelligence
(General cognitive ability: Good = Poor readers)

CTOPP: Comprehensive Test of Phonological Processing
(Phonological awareness: Good > Poor readers)

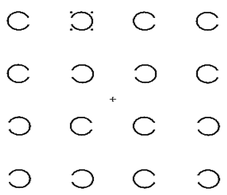


Figure 1. OSM stimulus

Session 2: Landolt-C, OSM, VAS

Landolt-C: Ring gap detection measure of visual acuity
(all in normal range)

OSM: Measure of distributed attention and re-entrant visual processing. Varied target location and mask offset delay (see Figure 1)

VAS: Partial and global reports of amount of parallel visual stimuli processed in one glance (see Figure 2)

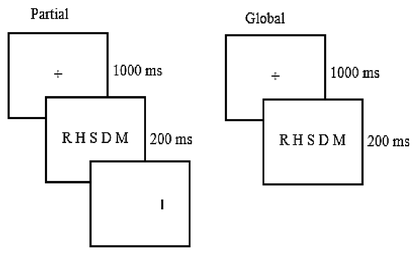


Figure 2. Sample VAS materials

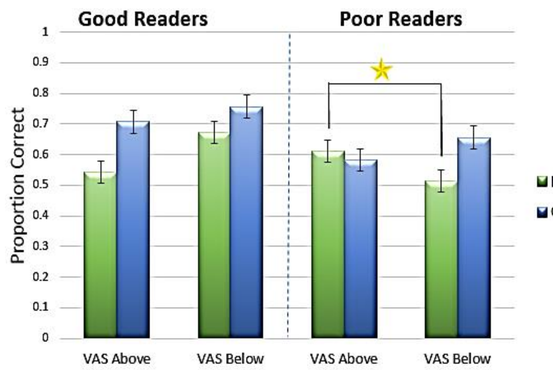
Results

Reader Group: Good, n = 18; Poor, n = 19

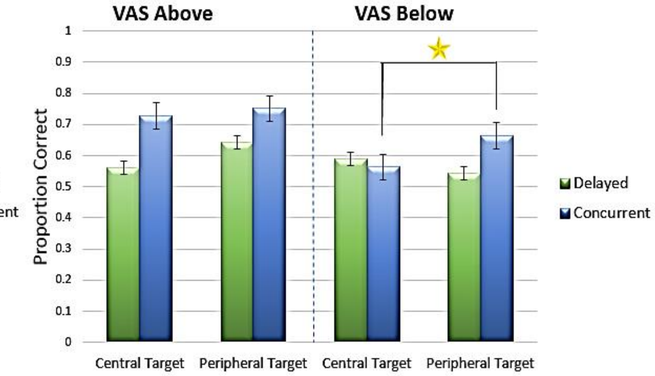
Visual Attention Span Group: VAS-above-the-median ($z \geq .14$); VAS-below-the-median ($z \leq .13$)

ANOVA on OSM accuracy found two 3-way interactions:
1. OSM Delay X Reader Group X VAS Group, p = .031
2. OSM Delay X Target Location X VAS Group, p = .043

Post hoc analyses conducted with Bonferroni-adjusted t-tests:
1. Poor Readers with VAS below do worse on OSM delayed (Graph 1)
2. VAS below do worse on central concurrent OSM than peripheral concurrent OSM (Graph 2)



Graph 1. OSM Delay X Reader Group X VAS Group



Graph 2. OSM Delay X Target Location X VAS Group

Discussion

Grade Four children are at the age at which reading begins to have broad implications on school achievement ("reading to learn"). Poor Readers were differentiated from Good Readers based on reading-related measures (TWRE and WRMT). OSM and VAS task manipulations replicated expected effects.

1. Contrary to expectations, VAS did not directly impact reading ability (r = .001 ns, and r = -.035 ns, for VAS correlation with TOWRE and WRMT respectively), but indirect influence was found in OSM outcomes (see Graph 1).

2. We observed a relationship between VAS and OSM in the delayed condition, dependent on reader group. Poor Readers with VAS-above-the-median did better on delayed OSM than Poor Readers with VAS-below-the-median (Graph 1). In contrast, Good Readers with VAS-above-the-median did the same on delayed OSM as Good Readers with VAS-below-the-median.

3. Overall, no relation was found between OSM and reading ability, except via mediation with VAS (see 1 above). Weak VAS resulted in poorer OSM performance for concurrent-offset masks.

Good VAS ability may be a protective factor for poor readers but not for good readers on OSM, and strong VAS may compensate for poor OSM performance. Results consistent with anomalous visual attention in poor readers.
Future research will focus on OSM in a subgroup of these children using an electroencephalography to examine event related potentials to delineate VAS influences in re-entrant processing through OSM.

References

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