The Relationship between Convergence, Divergence, Recognition, Tracking Skills Response Time, and Reading Achievement of Elementary School Students

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Abstract

The purpose of this study was to investigate the relationship between visual tracking skills and reading comprehension of elementary school children. Fifty-eight (58) elementary school students ranging from third to fifth grade were evaluated for visual skills and reading comprehension during the 2018-2019 school year. Data was analyzed using Pearson product-moment correlation to determine the strength of linear relationships between visual processing abilities and reading comprehension. A correlation matrix was utilized to determine correlation coefficients for all variables. A probability value of .05 was used to determine significance.

Introduction

Studies of the eye and its movements during reading can be traced back to the early 20th century. Many early discoveries of the eye were actually made during reading research, as early views of reading comprehension viewed it nearly as a totally visual process with little cognitive processing (Rada, et al 2009). While reading is no longer regarded as primarily a visual process, visual acuity is still an important component of reading achievement. A student cannot read what they cannot see or see well (McConkie, 1984).

The measurement of eye movements has proven to be a valuable tool for inferring ongoing visual and linguistic processing and an argument has been made that a lack of reflexive and voluntary skills might cause reading disabilities. However, there is currently a lack of a comprehensive model or research available regarding children’s visual movement in reading (Hustegge, et al., 2009). A recent study conducted by Ridha, Sarac, and Erzurum (2014) found that when an ocular deformity that effected visual acuity, defined by optometrists’ as strabismus, was corrected through surgery, the reading ability of the students showed almost immediate improvement in reading speed, accuracy and fluency.

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Results

Data was analyzed using Pearson product-moment correlation to determine the strength of linear relationships between visual processing abilities and reading comprehension. A correlation matrix was utilized to determine correlation coefficients for all variables. A probability value of .05 was used to determine significance. Preliminary findings for n = 58, r = .25, indicate a significant linear correlation between total Edge Score and Grade Equivalent of r = .251. Additionally, there was a significant linear correlation between Visual Recognition Response Time and Vocabulary of r = .27.

For 3rd grade: n=17 and critical r = .389
- There was a negative correlation (-.393) between eye convergence as measured by VEPT and total raw score.
- There was also a negative correlation (-.431) and (-.407) between VEPT percentile ranks and both total score on GMRT and ESS score on GMRT.
- Least amount of correlation.

For 4th grade: n=12 and critical r = .457
- There was a correlation (.657) between convergence on VEPT and vocabulary scores on GMRT.
- In Visual recognition response time there was a correlation between comprehension score (.468); total score (.503); grade equivalency (.646). There was also a correlation between visual tracking response time and grade equivalency total (.486).

For 5th grade: n=26 and critical r = .317
- There was a correlation between edge score and vocabulary score (.326); comprehension (.476); total score (.449); overall grade equivalency (.375) and extended scale score (.466).
- There was also correlation between convergence and comprehension scores (.336).
- There was also a correlation between Visual Recognition Percent correct and comprehension score (.371), total score (.35).

Methods

This study looked at 58 elementary students from 3-5 grade for visual acuity and reading achievement.

- Visual acuity was measured using the Visual Edge Performance Trainer (VEPT).
- The VEPT is a commercial software program developed and utilized by athletic programs including MLB that measures eye movement and visual acuity in six ways: Eye alignment; Depth perception; Convergence; Divergence; Visual recognition; Visual Tracking.
- Reading achievement was measured using the Gates-MacGinitie Reading test (GMRT).
- GMRT measures reading ability through a vocabulary section and a reading comprehension section.
- GMRT provides norm-referenced results in percentile ranks, stanines and grade level equivalency on a scale of 1-Post high school.

Conclusion

- Improvement over previous pilot study that suffered from some serious limitations.
- Larger sample size in this study (n=58) versus previous study showed emerging trends from pilot study (n=17).
- Correlation as sample size and grade level increased.
- Expect more trends to emerge as study continues at another size with a higher total sample size.

References