A Comprehensive Literature Review: Movement, Cognition and Related Disciplines in Neurological Development and Reading

Lisa B. KLINE1 & Marcia R. KARWAS2

1Masters Project from California State University, Monterey Bay, California, USA
2Eastern Michigan University, Michigan, USA – Retired Faculty

Abstract

Related to reading, this project combined usually distinct academic fields including Neuroscience, Special Education, cognitive research, physiology, psychology, biology, and auditory and visual processing; Kinesiology and Motor Behavior Sciences; Osteopathy and Surgery, Orthopedics and Pediatric Orthopedics; Neurodevelopmental Medicine; and, Behavioral Sciences and Upper Cervical Research. Sources were located with the use of at least 13 search engines as well as other traditional methods. Literature reviews examined publications from 1896 – 2012 that were data driven to examine dyslexia, atypical motor behaviors including sensory integration, poor ocular motor skills, neurological and behavioral issues complicating reading development, and other physiological traits such as head tilt and leg length disparity. The single discipline literature reviews yielded many threads of similarity connecting concepts between the usually distinct disciplines related to reading, including, but not limited to atypical motor development and muscle strength; ocular motor weakness auditory dysfunction; balance deficits, persistent asymmetrical tonic neck reflex, and neurological blood and oxygen flow.

Introduction

Atypical readers are at a disadvantage and although there have been investigations into reading and reading failure, little work has been done to bridge the gaps between the usually distinct disciplines to the topic. It would seem that by bridging the various areas of study and identifying similar findings between disciplines, our knowledge base will grow areas of study and identifying similar findings related to reading instruction. Systematic searches were conducted through computerized databases: Science Direct Elsevier; Academic Press; Academic Search Elite (Ebsco); CINAHL; PsychARTICLES; PsychINFO; Hotwire Press; Google; JSTOR Retrospective Journals; Sage Journals; Science Direct–Elsevier; SpringerLink; and Wiley Interscience Journal Backfiles.

Methods

Sources were used if 1) procedures and data-base results were published between 1896 – 2012, and 2) topics were relevant to connecting the concepts of atypical movement development, head tilt, leg length disparity, and dyslexia; related to reading instruction. Systematic searches were conducted through computerized databases: Science Direct Elsevier; Academic Press; Academic Search Elite (Ebsco); CINAHL; PsychARTICLES; PsychINFO; Hotwire Press; Google; JSTOR Retrospective Journals; Sage Journals; Science Direct–Elsevier; SpringerLink; and Wiley Interscience Journal Backfiles.

Results

The results of reading in specialized areas and combining the information yielded more interdisciplinary data than one might think. Although it is difficult to address all of the commonalities, generally the numbers of cross referenced references yielded the following major topics and similarities.

- Atypical Neurology
- Persistent reflex behaviors
- Postural control, balance and motor development
- Poor ocular muscle coordination, dyslexia
- Head tilt, asymmetry, hip/leg length inequality
- Regional cerebral and ocular blood flow, oxygen and exercise
- Special Education

Results (Continued)

Concepts and issues related to reading impairment can be targeted on this one model. This model is organized by hierarchy and could possibly be used by all academic fields as a starting point for concentrated interdisciplinary work among professionals who want to help individuals at-risk for learning to read.

"Functions at each level of the developmental model are interdependent on adequate functioning at each of the lower levels of the model" (Seaman, De Pauw, Morton, & Omoto, 2007)

Motor Skills – culturally determined running while bouncing balls, walking on the balance beam, dancing

Motor Patterns – commonly all humans rolling over, hand raising, walking, running, creeping, crawling, sliding, throwing, jumping, hopping, skipping (combination of hopping and walking), leaping, kicking, striking, galloping

Motor-Sensory Responses – planning and executing purposeful movement twisting, bending, lifting head, eye-hand coordination, eye-foot coordination; ability to use both sides of the body independently from each other, isolate one body part, cross midline, and maintain balance

Functioning of Later-Maturing System – visual, auditory hand-eye and eye-hand coordination; most closely linked to the vestibular

Functioning of Earlier-Maturing System – vestibular, tactile, proprioceptive understanding right from left, memory playing an important role; the same anatomic age

Innate Neural Capacity – reflexes; according to survival behavior; gene pool

Note: From Seaman & De Pauw (1989, p. 31) "The Developmental Model" [above], adapted from Seaman & De Pauw (1989) by Kanwos (2006, 2007), used with permission by Seaman & Kanwos, personal communication, October 10, 2012 [below].

Conclusion

This project concludes that there is work being done for readers with learning deficits in specialized disciplines, but very little interdisciplinary work is being completed. Now, perhaps is the time for scholars to begin working with others in varying disciplines or conduct interdisciplinary work themselves toward early identification, and serving struggling readers more efficiently. Practical applications to assist child support teams are needed regarding the influence of physical neurology on the quality of the learning process.

References

