

# REBOOTING INFANT LEARNING USING THE SYNPHNE DEVICE: A SOLUTION FOR CHILDREN WITH READING AND COMPREHENSION CHALLENGES

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## INTRODUCTION

- More than 80% of children who have Attention Deficit Disorder (ADD) and Dyslexia have reading and writing difficulties. In the USA, a staggering population of 14 million to 43 million respectively, have various levels of reading and writing difficulties. In the developing world, up to 17% of children have been reported to be facing similar difficulties.
- This feasibility study using the SynPhNe wearable system explores the effect of training children to maintain relaxed focus with the help of brain-muscle feedforward and feedback, and to utilize this while performing various tasks, including reading material appropriate for their grade level. The SynPhNe software user-interface mimics how infants learn, by leveraging sensory exploration and iterative goal-oriented learning.

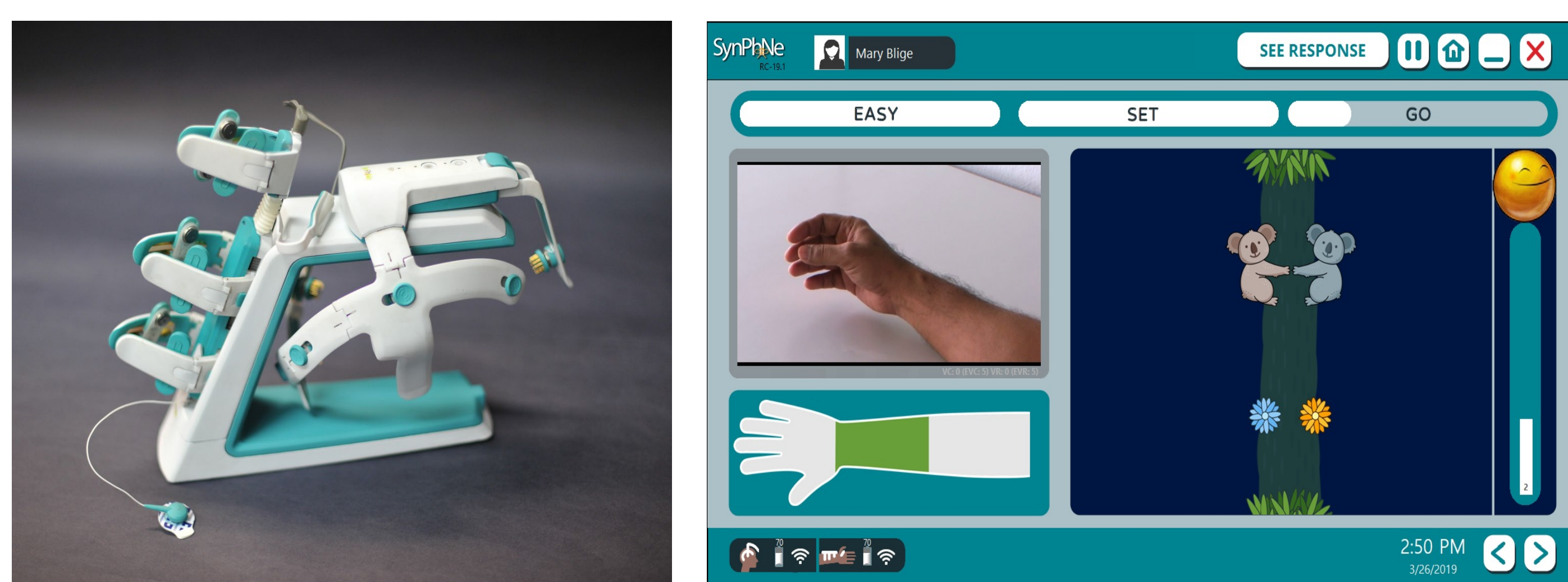


Figure 1. SynPhNe System

## METHODS

### TECHNOLOGY

- SynPhNe is a wearable, connected rehabilitation system which captures electroencephalography (EEG) and electromyography (EMG) signals in a time-locked manner and helps children "self-correct" movements and attention states in real-time using a specially designed user interface.
- This approach uses real-time feedforward and feedback to help maintain a relaxed, attentive brain state while executing tasks with appropriate muscle strategies. This includes English reading and comprehension tasks.



Figure 2. Setup of the feasibility study with SynPhNe device

## RESULTS

### CLINICAL SCORES OUTCOMES

- The primary outcomes were related to reading and comprehension, measured pre-trial and post-trial in age-months (TOWRE-2 SWE: SMD=29.50, SD=14.75; TOWRE-2 PDE: SMD=32.00, SD=16.00; JCDHD Test: SMD=25.83, SD=12.92). A short-term memory test (VADS) was used as a secondary outcome measure (SMD=24.67, SD=12.33).



Figure 3. Pre-trial and Post-trial scores comparison with respect to Biological Age (months)

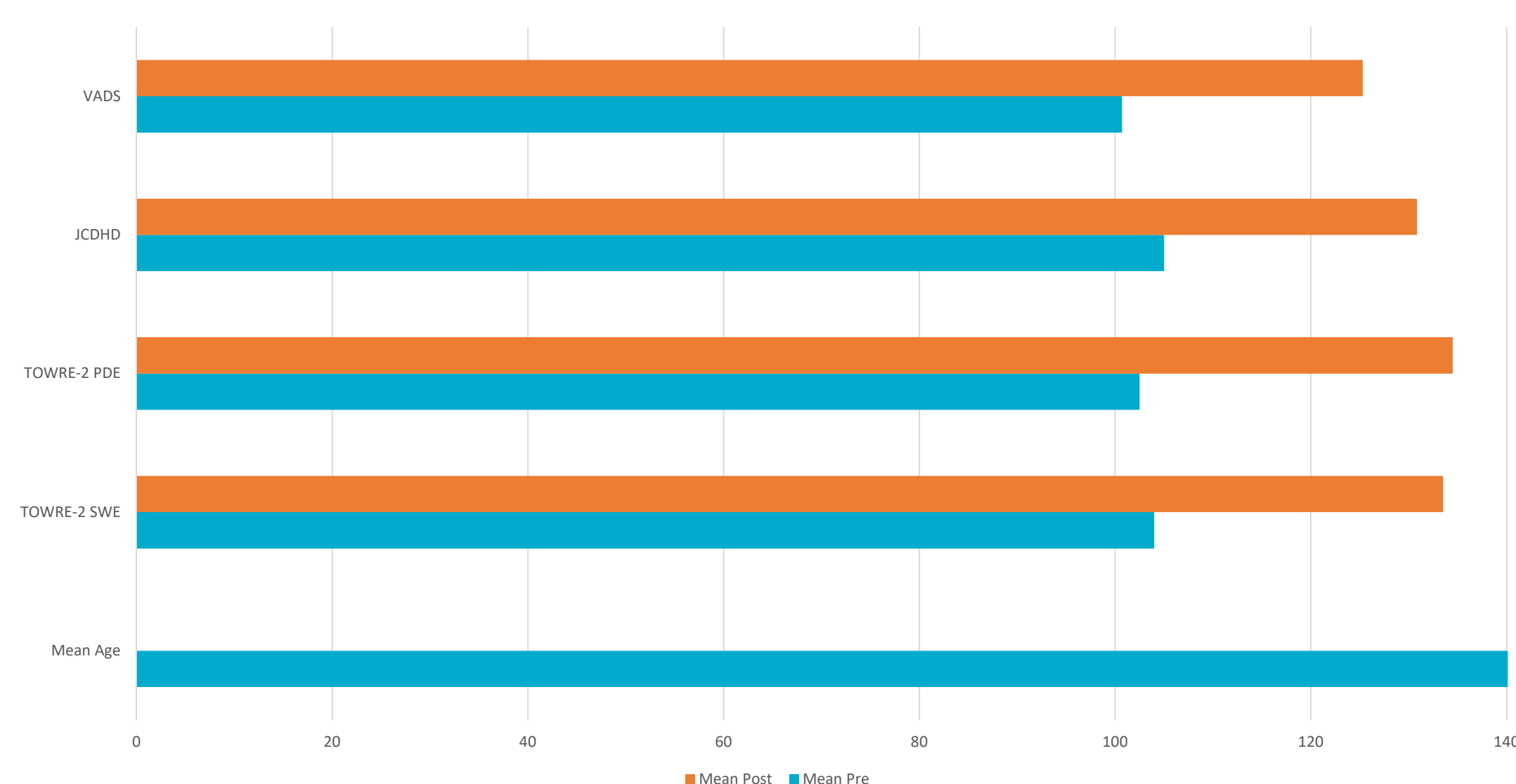


Figure 4. Mean Pre-Post trial scores with respect to Biological Age (months)

### STUDY DESIGN

- Six English reading children with learning disabilities (135-153 months age; 2 females, 4 males) were recruited. Each completed ten sessions of forty-five mins each, over four weeks using the SynPhNe platform. Frequency was 2-3 sessions per week.
- The protocol included video-led feedforward of arm movements [Pronation, Supination, Wrist Extension and Wrist Flexion] and activities [Let's Make Something, Let's Read, Let's Write, Let's Draw and some ADLs] while they attempted to maintain a pre-calibrated agonist-antagonist balance and relaxed attentive brain state, using the biofeedback. The session was led by a specialist who trains attention deficit and dyslexic children and is a certified SynPhNe Trainer. Assessments were done by a blinded, independent educational psychologist. Parents provided signed consent.
- Primary outcomes were measured using the Test of Word Reading Efficiency, Sight Word Efficiency (TOWRE-2 SWE), Test of Word Reading Efficiency, Phonemic Decoding Efficiency (TOWRE-2 PDE) and J. C. Daniels and H. Diack Reading Test (JCDHD).
- Secondary outcome was measured using the Visual Aural Digit Span (VADS) test. Children were tested pre-trial and post-trial.

## CONCLUSIONS

- Post-study participant testing indicated an overall mean of 28.00 age-months improvement (SD=2.92) in reading and comprehension age.
- Reading ability was largely maintained in a 3-month follow-up, while comprehension improved further in some cases.
- This indicates that the SynPhNe system is a promising new technology to be further tested in environments which serve children with reading and comprehension difficulties.

### IN ASSOCIATION WITH