

# Supporting the Spatial Working Memory Abilities of Students with Dyscalculia: An Aspiring Outlook on Neuroscience-informed Instructional Strategies and Math Intervention

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Improving Working Memory  
Supporting Students' Learning  
Tracy Packiam Alloway

April 3, 2013

Scientific Learning®  
Help Them Amaze You

Fast ForWord  
Building learning capacity through neuroscience advancement

Jungle Memory™  
Train your child's brain!

Can we use computerized interactive working memory training to address the problems of dyscalculia and support mathematical learning?

How can we use what we know from brain research and neuroscience-informed strategies to improve mathematics instruction in educational settings?

## Research findings:

- Students with dyscalculia have poor executive and spatial working memory skills which inhibit their ability to hold, manipulate, store and retrieve numerical information and representations. As a result, they are unable to learn basic mathematical concepts that subsequently build on each other.
- Current innovations in neuroscience and the slow merge of neuroscience and education provides educators the opportunity to discover new approaches and strategies that could complement traditional teaching methods in addressing dyscalculia.
- Existing neuro-scientific evidence promotes a brain-based approach to intervention for students who are struggling to read.
- Brain-based and literacy-based computerized training programmes like **FastForword** and **Jungle Memory** (Alloway) have been proven to improve the working memory and other cognitive processes of students with learning disabilities.
- There has been little attention given to neuroscience-informed instructional strategies that focus specifically on math intervention.



## Differences

- Student-Directed
- Adapts to a Person's Skill Level
- Game-like, animated exercises
- Only Computerized Exercises

**FAST  
FORWARD**  
**JUNGLE  
MEMORY**

## Recommendations for Future Research and Teaching:

- To promote further research into developing brain-based approaches to math intervention that will improve learning outcomes of students.

## Academic Math Intervention

+  
Methods that improve cognitive processing  
(WM, Attention, Processing Speed)

- Lessons like **Math Flash** demonstrate that it is possible for teachers to structure math interventions in a way that supports and strengthens the poor executive and working memory of students with dyscalculia.

## Interactive Computerized Cognitive Training Programmes vs. Intensive Remedial Math Intervention: Finding a Parallel

### Similarities

- Frequency + Intensity
- Targets WM, Attention, Processing Speed
- Goal-directed Behaviour
- Motivators
- Immediate Feedback
- Instructional Design to Minimize the Learning Challenge
- Ongoing Progress Monitoring

These elements are needed in a math intervention in order to improve and support the working memory of students.

**MATH FLASH**  
for fluent addition & subtraction math fact + number combination performance

0+0 =  
2-0 =  
3+1 =  
8-1 =  
6+2 =  
4-2 =  
13+6 =  
18-7 =

### Differences

- Teacher-Directed
- Instructional Explicitness
- Strong Conceptual Basis
- Directed lesson type of exercises
- Flashcards, computerized practice, paper + pencil review
- Daily Cumulative Review

## Selected References:

- Alloway, T.P., Bibile, V. & Lau, G. (2012). Computerized Working Memory Training: Can it lead to gains in cognitive skills in students? *Computers & Human Behavior*.
- Borman, G. D, Benson, J., & Overman, L. (2009). A randomized field trial of the fast forward language computer-based training program. *Educational Evaluation and Policy Analysis*, 31, 82-106.
- Fuchs, S. L., Fuchs, D., Powell, S. R., Seethaler, P. M., Cirino, P. T., Fletcher, J. M. (2008). Intensive Intervention for Students with Mathematics Disabilities: Seven Principles of Effective Practice. *Learning Disability Quarterly*, 31(2), 79-92.