Learning Difficulties Australia

Learning Difficulties Australia is an association of teachers and other professionals dedicated to assisting students with learning difficulties through effective teaching practices based on scientific research.

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1

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Master of Leadership: (with Distinction), Monash University, VIC. 2022

Doctor of Philosophy (PhD), University of New England, NSW. 2012
The Effects of Improved Automaticity in Basic Academic Skills: A Study of Learning Difficulties in the Middle-School Years.

Bachelor of Education (Special Education), UNE, NSW. 1998

Bachelor of Teaching (Primary), UNE – Northern Rivers, NSW. 1994

I have worked as a classroom teacher, support teacher and school advisor in schools in regional NSW for 10+ years.

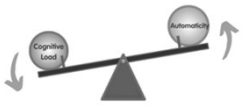
In 2014 I began working in the tertiary sector as a lecturer in inclusive education (Southern Cross University). In 2017 I was promoted to Senior Lecturer.

In August, 2022, I started working at Melbourne Graduate School of Education, in the Learning Intervention team. I am currently the Course Co-Ordinator for the Graduate Certificate in Education - Learning Difficulties

Now co-convenor of LDA's Consultants Committee

2

Automaticity in basic number facts: Freeing up the load.



- automaticity in basic number facts
  - the cognitive advantages it offers
- strategies and approaches to support the development of basic academic skills
  - for students experiencing learning difficulties
- differences between rote learning and developing automaticity
  - out with the old, in with the new

Image source: https://phonicshero.com/wp-content/uploads/seesaw-graphic-e1622554159110.png

3

3

Automaticity

- Memory (encode/decode)
  - Long term memory (LTM)
- Working memory
  - Limited capacity
    - Lower order aspects of the task have priority
- Practice needed for effective retrieval from LTM
  - Spaced practice of the knowledge
  - Practice retrieving the knowledge

4

4

Basic number facts

- Addition and subtraction facts to 10
- Multiplication and division facts to 12+
- Numeracy vocabulary
  - Vocabulary associated with basic facts
  - General mathematics vocabulary, e.g. geometry
- Problem-solving is the ultimate goal

5

5

The Multi-Store Model of Memory

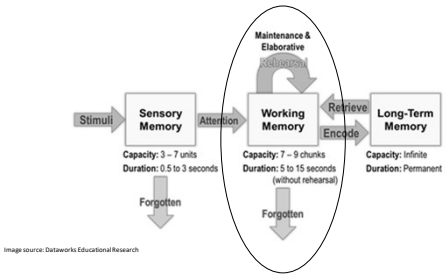


Image source: Dataworks Educational Research

6

Working Memory (WM)

- Working memory has been described as a theoretical construct used in cognitive psychology to characterise the system or mechanism underlying the maintenance of task-relevant information during the performance of a cognitive task (Miyake & Shah, 1999).
- Other definitions in the literature similarly describe working memory as a temporary, simultaneous storage mechanism in memory for incoming information required in the performance of a complex task (Baddeley, 1992; Hulme & McKenzie, 1992; Siegel & Ryan, 1989; Swanson & Keogh, 1990).

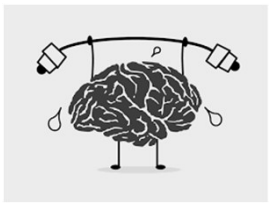


Image source: https://cogbites.org/2019/02/18/what-is-working-memory-training-and-what-makes-it-work/

7

7

Working Memory & Learning Difficulties

- Students who experience learning difficulties (LD) may
  - have reduced WM capacity
    - for all of us, our WM capacity is limited
    - Capacity can be predictive of future achievement
  - Use their limited WM resources inefficiently
    - Shifting focus
    - Emotions take up WM space
  - Over-rely on WM
    - 'work it' constantly instead of retrieving from LTM
- Caution: WM training has limited evidence base for having an impact on learning outcomes
  - methodological issues
  - future prospects
    - (Nutley& Söderqvist, 2017)

8

8

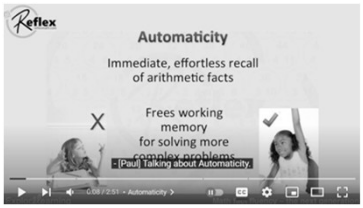
WM & Mathematics

- Mathematics, arithmetic, numeracy
- WMC predicts measures of current and future mathematical abilities, dependent on
  - Developmental stage
  - Exposure to mathematics training (effective teaching)
- Different components of WM are related to mathematics performance at different ages, and between aspects of mathematics within the same age
- During early stages of learning arithmetic most children use counting strategies, before developing verbal counting and finally, the counting will gradually be replaced by forming categorical representations in long-term memory
- For the same task, the strategies used to solve it might differ between students
  - Students experiencing LD tend to over-rely on inefficient strategies

9

Automaticity and arithmetic facts

- https://youtu.be/l8JlTqJYKUQ?t=8



10

Reducing the Load

- **Increasing the use of efficient strategies**
  - Developmentally appropriate
- **Using the limited capacity of working memory effectively to solve a task**
  - Not 'using it all up' on the lower order aspects of a task
    - Instead, retrieve the key information from LTM, and
    - use the available resources (WM) to focus on higher order aspects of a task
- **Clara's story – fast fingers**
- **Rosemary's story – not enough practice**

11

QuickSmart Numeracy

Yrs 3-8

- **SiMERR Centre**
- **Professor John Pegg**
- **(Professor Lorraine Graham)**
- **Anne Parnell**
- **Dr Maree Lake**
- **QuickSmart team**

- Average effect-size results for thousands of *QuickSmart* students (of 0.60 to 0.94)
- translates into growth of two- to three-years in one year compared to the gains made by average-achieving students.

12

How to achieve automaticity in basic maths facts

- Start with the known
  - Explore current understandings
- Needs more than a singular focus on recall
  - Not rote learning
- Spaced (distributed) practice
- Enough practice opportunity
- Confidence ….
- 'Trust your head' (replace old cognitive habits)
- The relationship between number facts
  - If you know one number fact, you know 4 number facts

13

How to achieve automaticity in basic maths facts

- Your suggestions ……

14

Automaticity Activities 1 (Yr 3-8 & beyond)

- **Always start with review – tap into prior knowledge**
  - Establish that conceptual understanding exists
- **Speed sheets**
  - NOT maths mentals
  - Retrieval practice of known facts, with a limited range (e.g. number facts to 10, +3, '3 times tables')
  - Teach strategies for doing the task
    - jump down the page, do like 'sums' at the same time
- **Flash cards**
  - Limited range in a known domain

15

Automaticity Activities 2

- **Games**
  - Memory, 3-in-a-row,
  - Online games BUT carefully selected
- **Self-record progress**
  - Graph rates each time
  - Expect/ explain variance
- **Embedded knowledge activities**
  - Problem solving
  - Include geometry, algebra, measurement etc.
  - TRANSFER AND GENERALISATION

16

How is teaching for automaticity in basic number facts different from rote learning?

- **Discussion**

17

Implications for your practice

- **Discussion**

18

References

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19

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20