Teaching Early Numeracy to Children with Developmental Disabilities

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Autism, participation and learning focus on preschool and school
Overview of today’s session

• What is Teaching Early Numeracy to Children with Developmental Disabilities (TEN-DD)?

• How do we know that TEN-DD is effective?

• How will TEN-DD benefit children that you work with?
What is TEN-DD?

- Evidence-based numeracy curriculum for children with developmental disabilities
- Published in a comprehensive practical guide, available on Amazon
- Book sets out key principles of teaching and learning
- Introductory context - chapters 1 to 3, I will be covering today.
- Book comes with a comprehensive set of online resources, including 90+ lesson plans
- Teachers and teaching assistants can be trained to deliver the principles described in the book
What is TEN-DD?

- TEN-DD is based on **Maths Recovery**
- This was developed initially for low attaining typically developing children (6-7 year olds)
- The curriculum is divided into **five developmental stages** with progressive levels of sophistication
<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>Typical skills of a child at this stage</th>
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<tbody>
<tr>
<td>Emergent</td>
<td>The child has some simple rote counting skills, but few numerical skills. That is, they either do not know number words or cannot coordinate the number words with items.</td>
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<tr>
<td>Perceptual</td>
<td>The child can count objects when they can see, hear and feel items and sometimes add small sets of objects that are present.</td>
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<tr>
<td>Figurative</td>
<td>The child can count well and use “counting-all” strategies to add. That is, they are able to count to find out the total number of objects in two separate collections. They can also do some simple subtraction tasks.</td>
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<tr>
<td>Counting On</td>
<td>This stage is at or above the average for most year 2 typically developing children (age 6-7). The child can add by “counting on from the larger number” and subtract by counting down; they can read numerals up to 100 but have little understanding of place value.</td>
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<tr>
<td>Facile</td>
<td>The child has developed a wide range of strategies other than counting in ones. They know some number facts; is able to use some derived fact strategies; can multiply and divide by strategies based on repeated addition; may have difficulty with carrying and borrowing.</td>
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<tr>
<td>Related Key Topics for the EMERGENT stage</td>
<td>Focus</td>
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<td>-----------------------------------------</td>
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<tr>
<td>Number word sequences from 1 to 20</td>
<td>Knowledge of forward number word sequences in the range 1 to 20 and backward number word sequences in the range 1 to 10</td>
</tr>
<tr>
<td>Numerals from 1 to 20</td>
<td>Knowledge of numerals in the range 1 to 20</td>
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<tr>
<td>Counting visible items (objects)</td>
<td>Perceptual counting strategies</td>
</tr>
<tr>
<td>Spatial patterns</td>
<td>Ascribing number to spatial patterns and random arrays. For example, counting and recognizing dots arranged in domino patterns and in random arrays.</td>
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<td>Finger patterns</td>
<td>Recognizing, demonstrating and manipulating finger patterns for quantities up to 5.</td>
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<tr>
<td>Temporal patterns and temporal sequences</td>
<td>Copying and counting temporal patterns and temporal sequences. For example, counting sounds or movements that take place in a sequence</td>
</tr>
</tbody>
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Teaching Activities within Each Key Topic:
Emergent stage- Number Word Sequences from 1-20

1. Short forward number word sequences
2. Short backward number word sequences
3. Saying alternate number word forwards
4. Saying alternate number words backwards
5. Saying the next number word forwards
6. Saying the next number word backwards
7. Saying the number word after
8. Saying the number word before
Numeracy Targets Organised:

Horizontally - different groups of activities within the same ability level – key topics

• Vertically - within each key topic there are progressive stages of difficulty.
• Emergent stage- 32 teaching activities
• Perceptual stage- 30 teaching activities
• Figurative stage- 42 teaching activities
• Counting on stage- 42 teaching activities
• Facile stage- 33 teaching activities

179 teaching activities
Theoretical Basis for Maths Recovery

- Constructivist methodology (see p, 27-28)
  - Very child led
  - Children expected to problem solve and come up with their own solutions and to provide rationale for their answers
  - Requires a high level of critical or abstract skills

- How suitable is this style of teaching for children with a developmental disability?
The Key Debate

• The debate hinges on the extent to which students require structure and supports from their teacher to learn new skills

• Instructional approaches can be put on a continuum
  - Constructivist approach - when less guidance is needed
  - Systematic Instruction - when more guidance is needed
What does the research tell us?

• Systematic Review evidence
  - Spooner et al (2019)

• Teaching approach associated with best outcomes is:
  • Systematic Instruction
Why might Maths Recovery be suitable to adapt?

• It is an evidenced based approach

• It offers a comprehensive approach

• It can be used with students who have yet to acquire any numeracy skills

• It involves an individualized teaching approach

• It has many elements consistent with systematic instruction (e.g., micro adjusting and scaffolding)
Adaptations

1. “What” to teach
   • - the curriculum/ lesson plans

2. “How” to teach
   • - pedagogy/ teaching strategies
Adaptations to the lesson plans

- Task analysis of difficult to teach skills - smaller steps
- Short, succinct verbal instructions
- Prompting and prompt fading suggestions
- Mastery criterion
- Generalisation strategies
- ...and written in an accessible format for teachers and teaching assistants
Structure of the Lesson Plans

Each lesson plan has six key sections:

- Target specification and learning objective
- Materials
- Teaching procedure
Structure of the Lesson Plans

Each lesson plan has six key sections:

• Target specification and learning objective
• Materials
• Teaching procedure
• Generalisation plan
• Help that may be provided
• Mastering criterion
Adaptations to the teaching practices

• Assessment interview replaced with probe tests

• Specification on strategies for how to increase motivation for learning

• Emphasis on repeated practice through using systematic instruction teaching procedures

• Fast paced sessions with monitoring (data collection) and feedback (e.g., error correction)
How may TEN-DD benefit children you work with?

- Improving numeracy attainment
- Enabling access to other areas of the curriculum and functional living skills
- Promoting the use of evidence-based interventions and raising standards in mathematics
- Promoting high quality, cost effective, individualized and small group instruction to children with autism and learning difficulties


How do we know that TEN-DD is effective?

- Research programme at the Centre for Educational Development, Appraisal and Research (CEDAR) spanning more than a decade
- Effective with young children as “first” numeracy programme
- Effective with older children as “catch up” numeracy programme
- Can be delivered one-to-one or in small groups
Which Children will Benefit from TEN-DD?

• Those children struggling to learn numeracy using the schools’ typical methods
• Primary and secondary school pupils
• Attending special or mainstream school settings
• Certain prerequisite skills required for maximal benefit, including imitation (so that modeling prompts can be used)
Charlotte Madine, Chair, Mathematics Recovery Council UK & Ireland

“This very useful book adapts the Maths Recovery Programme to suit the learning needs of students with a developmental disability. It provides an extensive and detailed approach to assessment, learning and teaching that embodies evidence-based best practice”.

"This much needed book is an essential read not only for educators but for educational leaders everywhere......... This book is a vital tool in maximising the numeracy potential of all children and I wish somebody had given this to me when I became a maths teacher more than 15 years ago".
THANKS FOR LISTENING!
IT'S TIME FOR QUESTIONS!

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