Navigating Mental Mathematics

Ofsted Review

OFSTED - Research review series: Mathematics

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Summary of key findings which directly relate to a MAP session

(29 pages – 10,500 words summarised in 750 words!)

The recent 2021 OFSTED research review into mathematics aimed to identify factors that can contribute to high-quality school maths curriculums: -

Types of Knowledge

Foundational knowledge, particularly proficiency in number, gives pupils the ability to progress through the curriculum at increasing rates later on.

Furthermore, if core content has been sequenced well and pupils have learned it thoroughly, they are less likely to forget and are therefore unlikely to need to 're-learn' it later

- **Declarative knowledge is static in nature and consists of facts, formulae, concepts, principles and rules: prefaced with the sentence stem 'I know that'.**
- **Procedural knowledge is recalled as a sequence of steps. The category includes methods, algorithms and procedures: prefaced by the sentence stem 'I know how'.**
- **Conditional knowledge gives pupils the ability to reason and solve problems: prefaced by the sentence stem 'I know when'.**

Linked declarative and procedural knowledge are ideally sequenced together to reflect the reciprocal learning relationship between them. This is because:

- **Familiarity with facts helps with learning and understanding the linked method**
- **Familiarity with the method helps to make associated facts firm & precise**
- **Knowledge of relationships between concepts develops over time**

Why do we need to learn facts automatically?

- **Prioritising core declarative knowledge in mathematics levels the playing field**
- **Pupils who are not able to quickly and easily recall maths facts struggle with calculations due to their working memory being overloaded**
- **Maths facts acquired because of familiarity aid their ability in mental arithmetic**
- **Children no longer need a counting frame once they have learned to recall the number bonds, sequences, patterns and rules automatically.]**

Teachers should seek to balance developing pupils' understanding with instruction in efficient methods that reveal new patterns and connections of number.

This is easier if mathematics leaders prioritise and value consolidation.
Understanding and computational proficiency reinforce and augment each other.

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SEND & Disadvantaged Pupils

- Pupils with SEND benefit hugely from explicit, systematic instruction and systematic rehearsal of declarative and procedural knowledge
- 'Novice learners' of new mathematics content need systematic instructional approaches similar to those used to teach early reading and writing. Teachers need to ensure daily dedicated time for teaching and practising component parts
- Disadvantaged novice mathematicians benefit from proactive approaches as simple as ensuring they are given dedicated time to learn & rehearse mathematics every day
- Too frequently, disadvantaged pupils are less likely to make progress compared with their peers. If coherent resources for planning, instruction and rehearsal of content are provided by leaders, then this risk is reduced while still giving teachers freedom to choose how to teach
- If anxious pupils acquire core knowledge and start to experience success, those pupils will begin to associate the subject with enjoyment and motivation.
- A proactive approach to helping children to acquire everyday language used to describe quantity, shape and time would also benefit disadvantaged pupils.

Why is there a need for systematic rehearsal?

- Proficiency in mathematics requires pupils to attain a level of procedural fluency.
- Teachers should ensure that they give pupils adequate opportunities to practise. This is more likely to increase pupils' levels of procedural fluency.
- In the most successful systems of mathematics education, systematic rehearsal is given more time and focus than in England. Teachers can plan future sequences of learning confident that pupils' foundational knowledge is secure.
- When lessons and therefore rehearsal opportunities are cut, attainment declines
- Extra rehearsal helps pupils attain automaticity in recall and use of facts and methods. This may explain the increases in attainment following the introduction of the 'numeracy hour'
- Evidence points to the need for opportunities to practise taught facts, methods and strategies, as well as additional opportunities for overlearning
- Systematic rehearsal of number bonds and sequences can draw on a canon of games and songs involving dice, dominoes and counting sequences.

Why is there a need for systematic rehearsal?

- Frequent, low-stakes testing can help prepare pupils for summative tests by providing memory-enhancing opportunities to recall and apply taught content
- Low-stakes testing works well when tests of mathematics facts, are timed
- When pupils obtain levels of proficiency, they look forward to and enjoy tests.
- The goals of trying to achieve a personal best and doing well compared to the average mediates later attainment.
- Teachers can set benchmarks for mastery of facts and methods so that they can be assured that pupils are recalling rather than guessing or deriving
- Competitive maths games are, for example, more effective for learning and retention than non-competitive games.

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