Mathematics Intervention Network (MIN) Starting Point

Researching the effectiveness of different intervention strategies and the impact they have on narrowing the gap.

How teachers can determine the right form of intervention for pupils from KS1 to KS4?

How to use this Starting Point

Research and Discussion

- What do we mean by intervention?
- What research is available on intervention?
- What form can an intervention take?
- What factors contribute to effective interventions?
- How can the effectiveness of interventions be measured?
- How can we plan an effective intervention (flow diagram?)
- Where can I find examples of intervention?
- What the network could explore

NCETM Portal Resources
- Teacher Enquiry
- Resources
- Courses & Training
- Mathemapedia
- Community (Communities and Blogs)

How to use this Starting Point

This Starting Point contains a broad base of background information and related research around mathematics interventions. Teachers will find it useful to read through this document, select and highlight the areas most suitable to the direction of network research. Whilst MIN participants may be aware of many useful resources related to this theme, there are also many links provided that will direct the network to other materials as well as resources on the NCETM portal.

The ‘What the network could explore’ section aims to pose questions for discussion amongst the network which may lead to further research. Alternatively teachers and/or teaching assistants may see them as complimentary questions to those already considered by the group for enquiry!

Research and Discussion

What do we mean by Intervention?

The limited research in this field does not define intervention precisely. In summary it is left to us to assume that it is the act of providing additional support in an educational setting, beyond the normal classroom provision for individuals or targeted groups who are at risk of falling behind. Most of the available research focuses on students who are falling behind expectation and, usually, falling behind the expected norms for their age/ peer group. However it is important not to rule
out intervention that might be necessary for other groups of pupils such as those who are identified as gifted and talented in mathematics but are not making sufficient progress.

**What research is available on mathematical interventions?**

It is widely appreciated (Dowker, 2004 [c], 2009 [d]; Wilson and Räsänen, 2008 [f]) that there is limited research available on effective strategies for supporting pupils with mathematical difficulties when compared with that available for literacy. Evaluations and reviews of interventions are also generally focused on pupils in the early phases of education – early years and primary.

Wilson and Räsänen, 2008 [f] suggest that this is because...

“..many studies fail to meet most of the requirements for high quality intervention studies, which is a reflection of the high monetary cost of and practical difficulties associated with such research. In particular, single-case publications and studies with very small numbers of participants are common, despite the fact that they limit generalization.” (p1)

What this means is that implementing any form of mathematical intervention is faced with many hurdles when attempting to use an intervention strategy that works on a small scale with a larger group of participants.

Dowker (2004) [c] reviews a range of different strategies and approaches to interventions for mathematical difficulties and in particular for arithmetic, focusing on pupils in the earlier stages of their education. She spends some time discussing what is understood by an ‘arithmetical difficulty’ and raises a number of areas where pupils may have difficulties in this area:

“...arithmetic is not a single entity, but is made up of many components. These include knowledge of arithmetical facts; ability to carry out arithmetical procedures; understanding and using arithmetical principles such as commutativity and associativity; estimation; knowledge of mathematical knowledge; applying arithmetic to the solution of word problems and practical problems; etc.” (pp4-5)

This is important to understand if a successful intervention is to be planned and taught.

She concludes her report with the comment,

“No two children with arithmetical difficulties are the same. It is important to find out what specific strengths and weaknesses an individual child has; and to investigate particular misconceptions and incorrect strategies that they may have. Interventions should ideally be targeted toward an individual child’s particular difficulties. If they are so targeted, then most children may not need very intensive intervention.” (p45)

...which illustrates the complicated nature of choosing, planning and teaching a suitable intervention programme for mathematical difficulties.

OfSTED (2010) [e] recently carried out a small scale review of the intervention programmes available from the National Strategies for primary and secondary schools to use. Intervention programmes are ‘off the shelf’ resources/ schemes of work designed to be executed by teachers or other professionals to tackle a particular difficulty. Although their review was not subject specific, OfSTED’s findings concluded that there was no one effective intervention programme but that
success was more likely to be determined by how well pupils were targeted, assessed and monitored and how the overall programme was managed within the schools.

In relation to staffing, one of the key findings of this report concluded that

“Intervention for small groups was most successful when teaching assistants were thoroughly trained, worked closely with class teachers, had good subject knowledge and knew the programmes and their pupils well.” (p6)

This then enabled the teaching assistants to adapt prescriptive materials and alter their teaching approach to suit their pupils’ needs. The recommendation that followed suggested regular and continuing training for any staff involved in the delivery of programmes.

Taking a whole school approach to intervention is a common message conveyed through the evaluation reports of the Ocean Mathematics Project in Stepney (2008) [a], East London and the Count me in too (2009) [b] project in New South Wales Australia. Both these reports comment on the importance of a shared commitment to intervention programmes within a school for the success of such projects and with a strong commitment from the senior leadership team throughout the implementation. In the Count me in too report which focuses on the impact of the project on teacher practice and pedagogy it was found that such projects had the potential to raise the standards of teachers’ mathematical subject knowledge and practice across the whole school where all staff were involved to some degree in the programme.

What form can an intervention take?

It is important to distinguish between an intervention strategy and in intervention programme. A strategy might refer to type of pedagogy being used where as a programme is the whole approach that might be made up of a range of strategies. Wilson and Räsänen, 2008 [f] summarise the variety of different forms that an intervention programme might take.

Instructional Methods (pedagogy)

Constructivist – the emphasis is on the guiding the student to construct their own meaning

Behavioural – the emphasis is on a teacher led approach, e.g. modelling a technique then the pupil replicates.

Cognitive – the emphasis is on the student employing strategies to help remember e.g. the use of mnemonics.

Representational – the emphasis is on models and images of mathematical concepts and concrete materials.

Situated cognition – the emphasis on relating subject material to everyday life.
Computer assisted instruction – the emphasis is on the student interacting with a piece of computer software.

**Delivery Method**

*Organisational* - include ability grouping, mainstreaming, retention, or reduction of class size

*Whole class* – used for preventative measures

*Small group* – pulling out of groups of individuals with similar difficulties

*Peer tutoring* – matching a competent peer with a less competent individual

*Targeted intervention* – fine grained assessment and profiling of an individual

**Intervention Length**

Wilson and Räsänen, 2008 comment “...that it appears that interventions do not always need to be long and costly in order to produce a change.” They mention that there is no optimal time for an intervention and that length will vary according to the individuals’ needs.

**What factors contribute to effective interventions?**

OfSTED’s (2010) review of the National Strategy interventions suggested the following contributed to successful and thus effective interventions,

“...ongoing and accurate assessments of pupils’ progress; regular analyses of such information; high and challenging expectations about where pupils should be at particular stages of learning; and secure knowledge about what could be done to bridge the gaps in learning. Senior leaders and teachers knew the various National Strategy intervention programmes thoroughly and selected those that were most appropriate to meet pupils’ specific needs.” (p11)

And...

“The key determinant for success was clear direction by senior leaders and the detailed preparation, training and knowledge of those responsible for putting the intervention into practice.” (p12)

The recommendations from the report that could help to ensure successful interventions are as follows.

“In order to improve the effectiveness of intervention programmes in schools, those responsible for leading and managing the National Strategies, nationally and locally, should:

- ensure that schools understand the importance of thorough identification of pupils’ needs and careful planning of programmes to meet those needs
- promote regular and continuing training for staff, including teaching assistants, who deliver specific intervention programmes
- support schools in monitoring intervention programmes and evaluating their impact.

In order to raise standards by improving the achievement of pupils targeted for intervention, senior leaders and teachers in schools should:
• analyse closely the weaknesses in pupils’ knowledge, understanding and skills against the available intervention programmes and approaches, to ensure that the correct strategies are used at an early stage
• ensure that all those involved in providing the intervention programmes, particularly teaching assistants, are trained regularly and thoroughly.”
• evaluate the effectiveness of intervention programmes, adapting them and combining them with other approaches such as good quality teaching to ensure that their impact is successful.

How can the effectiveness of interventions be measured?

A recommendation above for the National Strategies is to support schools in monitoring intervention programmes and evaluating their impact. None of the research mentioned talks specifically about a tool that can enable this process and there is currently no support for schools via the National Strategies website to do this. The messages from the criteria that help to make a successful intervention can be considered in drawing up a list of questions to consider when evaluating and measuring impact of an intervention. It is important to consider these questions before assessing, planning and teaching the intervention.

• How will the students be assessed before and after the intervention?
• What metric of improvement will be used in the pre and post assessment?
• What will be the minimum expectations from the intervention?
• What other factors will be considered in contributing to the effectiveness of the programme?
  o Timing?
  o Frequency?
  o Resources?
  o Staff training?
  o Communication?
• How will pupils be tracked post intervention?

Resources for tracking pupils attainment:

Below is a list of some software packages that some schools have used to track pupil progress. PpIT has a function to identify a particular intervention for specific pupils.

• PpIT
• Wauton Samuel
• Essex Target Tracker

How can I plan an effective intervention (flow diagram?)

(See separate file)

Where can I find examples of intervention programmes?
Dowker’s (2009) second report provides an evaluation of many intervention programmes available to primary schools.

What works well site - SNS – limited case studies on mathematics intervention

Teachers TV – Intervention Strategies – Primary/Secondary – two 15-minute clips

Case studies for using Numicon

Wave 3 Mathematics (PNS)

Springboard Mathematics (PNS)

Booster Y9 (SNS)

Overcoming Barriers 1-2 (PNS)

Overcoming Barriers 2-3 (PNS)

Overcoming Barriers 3-4 (PNS)

Securing Level 1 (PNS)

Securing Level 2 (PNS)

Securing Level 3 (PNS)

Securing Level 4 (PNS)

Securing Level 5 (PNS)

What the network could explore

- How can we create a whole school approach to intervention?
- What form does our intervention currently take? Could we explore the different instructional and delivery methods to find a more effective approach?
- Having read through some of the research and OFSTED reports, are there any specific contributing factors that we could explore further?
- How can we effectively measure the impact of our intervention programme?
- As teaching assistants, which areas of mathematics could we develop to support the implementation of an intervention programme? How could we use the Self-evaluation Tools to audit current subject knowledge? How will we research progression and pedagogy? How could we evaluate the impact of this new knowledge on the delivery of the intervention programme?
- Any other line of enquiry that interests the group

NCETM Portal Resources

This is a selection of resources available on the NCETM portal that relate to developing and implementing a mathematics intervention programme.
Resources

Cloverhill Infant and Nursery School – Numicon Case Study

Secondary Learning Module GCSE C/D

Numbers Count Teacher - Reflections

Mathemapedia

Articles on misconceptions in mathematics

Community

Search results for ‘intervention’

Blogs

Kangaroo Maths (linked from here)

References


[d] Dowker, A.,(2009), What Works for Pupils with Mathematical Difficulties, DCSF

[e] Ofsted, (2009), An Evaluation of National Strategy Intervention Programmes, HMI