



for ages 3 to 18+

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Realising
potential in mathematics
for all

I love my year 8 class



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Realising
potential in mathematics
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Designed by Nicole Lane

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Gathering Momentum

I think this is an apt title for the introduction to the Spring edition of *Equals* and I will explain why. Momentum depends upon mass and as I write the critical mass of *Equals* is growing and with it we will be able to do so much more. It has been a real pleasure to talk with the colleagues who have contacted *Equals* offering to help. Mark Haddon, a member of the editorial team from some years back, got in touch with an article that we will include in the June issue. It is also only natural that such contacts will bring change, whether in direction or speed, and when Barbara Rodgers of the Solent Maths Hub called looking for help I knew something special would emerge. I will share more of this development in June but for now 'watch this space'.

This edition is rather eclectic as we have included the full range of pieces that have been sent to us since Christmas. I feel this is a good way of highlighting that the aim of *Equals* is to support those who are working to help our weaker students grow and blossom as mathematicians. Please get in touch to let us know what you think about our publication and also if there is anyway you can help. More importantly please share with us your classroom stories and anecdotes of how you are help your own students develop as mathematicians.

This edition includes the following pieces:

- Louise Gowan who is very open about her struggles within a special school,
- Cairo English School who are using mathematics to create a frenzy about maths,
- An interview with Lynda Maple a long-term supporter of *Equals*,
- A very thoughtful piece by Sarah Slezenyov on the benefits of lesson study,
- Some thoughts on the potential of the Maths Hubs by Lucy Cameron,
- Book and resource reviews by Peter Jarrett and Mary Clarke.

The purpose of *Equals* has not changed since its genesis as the publication 'Struggle'. The reasons for the birth of *Equals* were very clearly articulated in our last edition by Ray Gibbons. I was thinking about this recently as I was working with some KS 2 teachers on a series of Thinking Math's or GAME lessons. Some of the Year 3 and 4 participants were coming under pressure to teach prime numbers to their pupils so that their colleagues in Year 6 could 'push' their charges towards the Level 6 test. That revelation opened the flood gates and a whole host of fears and worries about the pressure to deliver content came forth. I believe that all children are born with the ability to explore the world around them and that thinking mathematically is part of this exploration. The tension in many classrooms comes from the rather narrow view of numeracy as a series of facts to learn and competencies to demonstrate. This has led to many 'difficult' concepts being 'taught' far too early. To resolve this argument and bring an element of balance I shared a piece I had read from the 19th March edition of the New Scientist magazine on prime numbers. This served

to highlight the need to explore, articulate and describe patterns as a key feature of mathematics. What really interested those teachers was how much such exploration is part of the daily life on 'real' mathematicians. In the article it states that: "Understanding primes is key to deciphering the

fundamentals of arithmetic. Mathematicians don't have a way to predict which numbers are prime, so tend to treat them as if they occur randomly."

Happy exploring and please let us know how you get on!

I love my year 8 class

Louise Gowan has been teaching in a special school for many years. As part of a series of articles she shares the highs and lows of working with those for who this publication was devised.

I love my year 8 class. They are kind, keen, polite, helpful, LOVELY! They want to do the right thing, they want to learn and they want to please. They will attempt anything. They will not give up. They come to lessons with enthusiasm and engagement. They help each other and can work co-operatively. They tidy up without being asked.

All pupils in my school have statements of Special Educational Needs. The pupils in my year 8 class have significant learning difficulties and have severe language and communication needs. They are working at NC level 1, Reception/Year 1. All of them can all count to 10 and enjoy doing this through song or activity. Most can count to 20 and some can count beyond using number tiles or a number track. The class can count in 2s, 5s 10's together with some prompting and support. Although they can do very little formal written work completely independently they will all have a go, ask for appropriate support and are amazing at persevering and completing any task set. Most of them need support to read or write a simple sentence but are still positive, confident and proud

of their work. When I was checking Annual Reviews recently I was pleasantly surprised to see that in their pupil input a few of them had written 'I am good at Maths'. I have always believed that pupil confidence is essential to pupil success. While I think it is essential for pupils to be realistic about their abilities or future possibilities I am against crushing pupil's dreams. When pupils have struggled for years with their learning and still do not see themselves as failures then I see this as success. Who knows what their futures hold? Their belief in themselves, their confidence in their learning will enable them to continue to grow and develop. 'Never Give Up' is one of my favoured phrases. I never give up on a child and I try to encourage them never to give up on themselves.

My year 8 class enjoy singing counting songs and using the various toys that I have in my room to create number stories. I have learnt from my pupils and colleagues that these children need concrete experience and play to learn. They enjoy working together to do counting and problems solving. I believe that group work and communication skills

are essential to learning and should be a part of every classroom. When we do work on the interactive board pupils take turns in being an additional teaching assistant, taking charge of the computer or using lolly sticks with names to decide who answers the next question. They always help set up the class, giving out books, pencils, rulers and they know where equipment such as number lines or 100 squares or cubes (or cuddly toys) are to help them with their maths. As well as a focus on maths skills I believe they need to develop those general thinking and social skills which underpin learning. Meta-cognitive skills have been shown to support learning. I sometimes talk about thinking and learning, mentioning (or even showing) brain cells and the need to see, hear and do in order to consolidate learning. At the whiteboard we will see a question, read it, do it. We use equipment to re-enforce this.

The last topic was division. 8G know about sharing. They are good at sharing with their friends and family so have a concept of sharing. They do not understand this in an abstract mathematical sense. They need practical and concrete activities to re-enforce the idea of sharing. I tried to start to make the link between sharing with friends and calculation in maths.

We started by sharing money (real money) in envelopes. In pairs they counted how much money they had in their envelope and then shared it with their partner. We then presented this to each other. We repeated this with toys such as cars, cuddly toys, small figures, cubes. The pupils chose what they wanted to use and worked in pairs. I swapped pupils so that they worked with different people in the class which they are now happy to do. Once

we had practiced this a few times, talked through different stories, considered use of vocabulary and written some simple examples on the board pupils went to their desks to try to draw and write about their number stories and start to write number sentences.

My year 8 class need practical and concrete activities in order to make sense of the maths. This can make it difficult for me to record evidence of their learning. I try to strike a balance between recording learning and just doing.

Every lesson we do a lot of speaking and listening because this is what they find difficult and so this is what they need to practise. I learn from my colleagues. Ria is a primary school teacher who has been Maths co-ordinator in her school. She has encouraged me to do practical work and not worry about recording everything which has been very helpful. Sind delivers Numbers Count, has worked 1:1 with some of my year 8 pupils and supports me in delivering appropriate lessons to year 8.

We are using John Hattie's evidence based teaching to inform our practice. I use orange and green marking to check work, challenge pupils and encourage pupils to reflect on their learning. As part of the visible learning project that I am involved in I am looking at how my pupils understand their learning. I have started by asking them 'what have you learnt?', 'what do you need to learn next'. At the moment pupils can site topics or vocabulary relating to recent topics. My challenge now is to develop these into conversations, into a more detailed description and understanding of the maths they have been studying.

Lesson study in the UK: possibilities and challenges

In this piece **Sarah Seleznyov**, of The Institute of Education, reflects upon the benefits that the correct use of lesson study can bring to all our classrooms.

Lesson study is a collaborative approach to professional development approach that originated in Japan. It involves a school or group of teachers identifying a learning need for the pupils they teach (the research question). The group of teachers then co-plan a lesson over a period of time and in some detail that addresses the research question. This planning process includes reference to relevant material, for example research papers, curriculum material, teacher guides or other lesson study reports. This process of study is called

kyozai-kenkyu. The lesson is then taught by one of the teachers, whilst the others observe the learning (the research question). After the lesson, the teachers meet to explore their observations and draw out what they have learnt in relation to the research question (the post-lesson discussion).

Fernandez (2002) defines lesson study as ‘a systematic enquiry into teaching practice..., which happens to be carried out by examining lessons’.

Lesson Study is...	Lesson Study is not...
Developmental for teacher	Judgemental of teachers
An opportunity to closely observe pupils' learning in a classroom environment	Judging the teacher against Ofsted Criteria
About a jointly planned and jointly 'owned' lesson	About teacher delivery of a lesson they 'own'
Research based and focused on evidence, including what has been seen and heard in a given lesson	About what we imagine is happening
Challenging yet supportive	Critical and unsupportive
Problem solving together	Identifying issues for someone else to resolve
A collaborative analysis of what leads to successful learning	Demonstrating one person's formula for successful teaching
Context specific and concrete	Generic and theoretical

A series of discussions and observations	A one-off observation
An honest and open process of collaborative planning and reflection	Planning behind closed doors and teaching in isolation
About teacher learning in relation to the research theme	About creating a 'perfect' lesson

With thanks to Paul Foster, Hayes School Bromley

Since 1999, when Stigler and Hiebert first wrote about lesson study as a model for improvement of classroom practice for mathematics, lesson study has enjoyed an enduring fascination for teachers around the world and increasingly in the UK. Time and again, in different international contexts, lesson study research has demonstrated positive effects on both the development of teacher practice and pupil outcomes in maths.

However, whilst recognising the appeal and power of lesson study for countries beyond Japan, research has shown there are challenges to be overcome for schools wanting to adopt the approach in the UK. Chokshi and Fernandez (2004) state that 'lesson study is easy to learn, but difficult to master'. They worry that a focus on structural aspects of the process or an attempt to mimic its superficial features might dilute its impact.

What are the challenges to successful implementation of lesson study identified in the research literature and how can schools address these challenges to ensure lesson study really makes a difference to learning in mathematics?

a. Time: How will teachers find sufficient time for lesson study? The process of designing a research lesson in Japan can sometimes taking

more than half a year and it is usual to devote 10-15 hours of time over a 3 to 4 week period to one research lesson. While this amount of time commitment may be difficult to achieve in the UK context, if schools want to get real impact from lesson study, teachers need dedicated time for planning and release time for research lessons and post-lesson discussions. Teachers also need to be willing to devote the required time to the writing of significantly more detailed lesson plans than they would normally use, if they are to see the true benefit of lesson study.

Implications:

- ✓ *Can the school's professional development timetable be reworked to accommodate lesson study time?* Schools we have supported have dedicated staff meeting time to lesson planning, reworked timetables to create shared planning time and/or used part of INSET days to accommodate planning. They have looked flexibly and creatively at cost-effective ways to release teachers to attend research lessons and post-lesson discussions. Some have also moved away from the need to run several cycles of lesson study within a year and considered the value of teachers participating in research lessons

that address a school or department research theme, even if they were not part of the planning group.

- ✓ *Do teachers know what research tells us about the importance of anticipating pupil responses?* What is really useful about the best Japanese lesson plans is their attention to detail in planning and anticipating pupil responses and teacher actions. We know from a significant body of mathematical research (eg Fennema and Loef, 1992) that the ability to anticipate pupil misconceptions is a strong predictor of teacher ability and therefore successful learning. If teachers understand this, they may gain an understanding of the value of such detailed planning. The lesson plan we developed for our schools built in a focus on predicting interactions in the lesson to show how important this is for teacher learning.

b. The UK education system's desire for quick results (student performance): The focus in the UK system on quantifiable pupil outcomes has had the unfortunate consequence of encouraging those investing money and time in a new initiative to want to see short term improvements to pupil assessment data. Researchers argue that the qualitative evidence gleaned through lesson study is more valuable than pupil tracking data: lesson study is not about quick fixes, but about small incremental changes to teachers' practice over time. For the Japanese, lesson study is about the development

of expertise over decades, not months.

Implications:

- ✓ *What qualitative evaluation of lesson study should we carry out?* We devised a set of tools for our lesson study projects that enabled them to capture not only the impact of lesson study on teachers but also the impact on pupils in qualitative terms. We know that confidence and engagement in learning are precursors to successful learning outcomes so these qualitative outcomes are vital to capture.
- ✓ *Can we track lesson study over time?* Real impact on learning is long-term and sustainable. We need to avoid the 'quick fix' mentality that might assume lesson study is something you do and then finish with. Lesson study is an approach to professional development that should be long term and it may take more than one year for a school to feel they have really 'cracked it'.

c. Teachers' unfamiliarity and lack of access to research: Several US researchers described how teachers involved in lesson study found it difficult to develop a research hypothesis, to design an appropriate classroom experiment to test the hypothesis, to gather and use appropriate evidence, and to generalize the findings. Similarly, UK teachers are likely to struggle to locate relevant material for the research (or *kyozai kenkyu*) that is a crucial part of the lesson planning process. Without this, teachers planning a lesson may be stuck within their own frame of

reference and not be building on what is known from research and good practice examples.

Implications:

✓ *How can we support teachers to develop skills as researchers?* We ran programmes to enable teachers to develop these skills as part of the lesson study process. Teachers needed support with visualising the expected impact, generating research questions, gathering evidence during observations of lessons and identifying themes in post-lesson discussions. These skills are of course, not only useful for lesson study but for the development of teaching and learning more broadly.

✓ *How can we ensure teachers access evidence-based material?* There is a lot of useful material available – if you know where and how to look. The role of leaders of lesson study was key here, as we were able to familiarise them with a range of free online sources of research and good practice material. Getting access to a university library can also be useful as this often enables you to view a wide range of online journals for free.

d. Subject expertise: This is a particular problem for primary practitioners who will often openly acknowledge their fears about their own mathematical understanding. In Japan, all primary teachers develop a subject expertise that relates to their chosen

lesson study group. All Japanese teachers also have access to many state-approved teacher manuals and textbooks guiding them in their understanding of mathematical progression and likely misconceptions.

Implications:

✓ *Can subject expertise be developed through lesson study?* Several researchers have argued that if lesson study is successful, it is one of the most effective ways to develop teachers' subject expertise in mathematics. Our early findings on projects in the UK indicate that there was a growth in teachers' perceived subject expertise and pedagogical content knowledge (ie the ability to translate subject matter into meaningful learning experiences for pupils).

✓ *Can we use outside subject expertise to add value to the lesson study process?* Some US projects used an initial subject expert's input to kick off the lesson study process, using this as a form of *kyozai kenkyu*. Several of our schools have incorporated such learning experiences into their lesson study annual cycle.

There is a lot of useful material available – if you know where and how to look.

Lesson study is not about judging teacher performance but about observing pupils' learning.

e. Lesson observation as performance management: The UK's high-stakes accountability frame has left many teachers feeling anxious about lesson observations, seeing them as a threat to their jobs. Lesson study is not about judging teacher performance

but about observing pupils' learning. The lesson plan and the research lesson are jointly owned by all teachers in the group. For UK teachers, this involves a shift in culture in terms of watching lessons and being watched.

Implications:

✓ *Can lesson study change the culture around lesson observation in your school?* As schools move away from judging individual lessons, lesson study has been used as a vehicle for refocusing lesson observation on learning and improving, rather than on performance and improving. By establishing shared ownership of the lesson, focusing observers on pupil learning and encouraging risk taking and experimentation, lesson study leaders can shift teachers' thinking.

✓ *How can protocols help enable a shift in culture?* A level of formality and the use of protocols for different stages of the lesson study process have helped schools we support to avoid the use of judgemental

language, establish shared ownership of research lessons and focus observations on learning (not teaching) in post-lesson discussions. The role of the leader has been key here: in Japan, a post-lesson discussion has a formal chairperson and we have found this to also be effective in UK lesson study projects

✓ *How should senior leaders be involved in lesson study?* We drew up a set of guidelines for senior leaders in consultation with teachers participating in lesson

study, suggesting how best senior leaders could support the lesson study process. Teachers felt their most significant role was in protecting dedicated time and setting realistic expectations about impact on learning. They agreed that it might be useful for senior leaders to observe the process, but that this should only be with the consent of the planning group and as a silent observer. Teachers were particularly keen not to see lesson study being included in performance management in any way.

f. Schools using lesson study operating in

isolation: Japanese lesson study groups operate within networks of schools that can share findings and pool professional knowledge. Access to such a network means teachers are able to think beyond their own frames of reference and build on what is known, rather than reinventing the

teachers are able to think beyond their own frames of reference and build on what is known, rather than reinventing the wheel

wheel. Such networks do not exist in the UK as many schools using lesson study operate in isolation.

Implications:

✓ *How can we connect to other schools doing lesson study in the UK?* An 'open house' lesson study was used by one of our projects to encourage local interest and engage nearby schools in lesson study; senior leaders from nearby schools were invited to observe a research lesson and participate in the post-lesson discussion. There are several national networks of schools using lesson study as an approach to professional development and it is worth accessing these

networks and making connections. The Institute of Education also runs a lesson study discussion forum (see link on next page), where you can meet like-minded schools.

learning. We need to recognise the challenges of adopting a professional development practice from another country, but also acknowledge that there are ways to creatively address these challenges, without losing the principles and good practices that underpin the lesson study process.

g. The lack of ‘expert others’ (or *kochis*): Stigler and Hiebert (1999) noted the importance of the ‘outside expert’ (*kochi*) in the lesson study process. This might be a university professor, local advisor or a very experienced teacher. The *kochi* may attend the planning sessions, but will also always observe the research lesson, pull together the ideas shared in the discussion, and tie what is explored to larger subject-matter and pedagogical issues. They also support networking across schools as they often act as *kochi* for a wide range of schools in the area. UK schools do not have access to such a pool of experts without digging deep into ever emptying pockets.

For more information on lesson study or to purchase the IOE lesson study handbook, contact: Sarah Seleznyov, s.seleznyov@ioe.ac.uk

To find out about our lesson study leadership programmes, visit:

http://www.lcll.org.uk/uploads/2/1/4/7/21470046/leading_lesson_study_across_schools_flyer.pdf

To join our lesson study discussion forum, visit:

<http://www.lcll.org.uk/lesson-study-forum.html#/>

For access to the IOE online journal libraries (and a wealth of other useful resources), join the IOE R&D network: <http://www.ioe-rdnetwork.com/>

Implications:

- ✓ *Can we access ‘experts’ from local schools or universities?* SLEs in your local teaching school alliance or experienced teachers in nearby schools might be able to take on the role of *kochi* with the right professional development. We are putting together a programme to support teacher-leaders wishing to understand the *kochi* role, in response to local need. Your local university may also be able to support your lesson study project. Members of the Institute of Education’s maths department have acted as *kochis* for local lesson study groups.

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- Fennema, E. and Loef, M, (1992) *Teachers’ knowledge and its impact*
- Stigler, J. W., & Hiebert, J. (1999). *The teaching gap: Best ideas from the world’s teachers for improving education in the classroom*. New York: Free Press

Did you know that a Beluga whale’s calls are an ear piercing at 220 dB but the noise created by the seismic oil exploration process comes in at 210 dB. Even an Icebreaker can cause problems for them as they create a whopping 183 dB.

If lesson study is working well, it has a powerful and transformatory effect on mathematics teaching and

Math's talk

Math's talk is a new feature; one in which the editor interviews those who have had an impact within the field of mathematics education. In this first interview Lynda Maple shares some of the highpoints on her life-long journey that is mathematics.

Could you describe some of the key moments in your career?

Without doubt it was become an advisory teacher within ILEA (Inner London Education Authority). It was during this time that I had the privilege of working within a range of schools and learning from such a diverse mix of teachers and their pupils. This then led to me becoming an Advisor and the opportunity to organise and run math's courses. In 1986 I set up BEAM (Be A Mathematician) with Anita Staker that set out to produce materials to support teachers to teach mathematics with and for understanding. This then led to my working with her during the early days of the National Numeracy Strategy.

A key milestone in my career came in the late 90's when I attended a Thinking Math's or CAME (Cognitive Acceleration through Math's Education) 2-year training course. I then moved to the Education Action Zone in Islington where I was able to support schools to explore the Primary CAME materials.

Who has been the biggest influence upon you?

This was David Fielker, the Director of the ILEA Math's Center in South London. Every Friday he not only did he lead the meetings of the math's team

but he encouraged and supported us to explore the nature of mathematics by doing math's ourselves at our own level. I will never forget those times of collaboration and exploration.

Mixed ability or setting?

Mixed because of the richness of the classroom. I find mixed groups promote and foster a broader discussion among the pupils.

What are your thoughts on some of the recent developments in mathematics education?

It saddens me that things have gone downhill in the last few years. The emphasis upon coverage and procedures has diluted the original aims of the numeracy Strategy away from understanding.

I always look to see if the teacher is interested and knowledgeable and able to engage her pupils.

When you observe a math's lesson what do you look for?

I always look to see if the teacher is interested and knowledgeable and able to engage her pupils. I try to get a feel for how they foster enjoyment of mathematics among the class and if they genuinely seek to develop the thinking of their pupils. A key feature of the pupils is if they are able to take on a challenge and then to talk about their ideas and listen to ideas of their peers. One word stands out

for me here and that is enjoyment: do the pupils enjoy their math's lessons and is this reflected in the feelings of their teacher.

What advice would you give to anyone who wishes to support the lower ability pupils within their classroom?

Be aware of what your pupils can do and start from

there. Allow your pupils to learn from their peers and talk to them to improve their self-image of themselves as learners of mathematics. Provide time for them to share their ideas so their peers can help and create a classroom culture where all students are not afraid to 'Have a go!'

Maths Hubs

Lucy Cameron keeps us up to date on how the maths hub programme is helping to improve the mathematics teaching and learning in SEN schools in the North East of England.

What are the Maths Hubs?

The national Maths Hub programme is a government funded programme that is coordinated by the National Centre for Excellence in the Teaching of Mathematics (NCETM). The programme, now in its successful second year, is designed to bring together excellent mathematics practice within regional hubs. There are 35 of these hubs across the country and they are locally led by an outstanding school or college. These hubs can harness best practice, expertise and leadership within the hub and allow colleagues from other provisions access to these excellent opportunities, particularly empowering leadership teams to develop their teaching and learning strategies and encourage collaboration. The hubs work in two ways; national collaborative projects with all hubs working to address an area; and, local projects which are tailored to local area needs.

What is the Great North Maths Hub?

The Great North Maths Hub is led by the North Tyneside Learning Trust and Churchill Community College as the lead school, it covers a wide range of areas within the North East including Northumberland, Tyne and Wear and County Durham. The areas of focus for the North East Maths Hub are:

- To identify and draw together existing Mathematics networks, resources, and expertise.
- To coordinate a range of high quality specialist mathematics support to address needs. Communicate existing support and extend its reach.
- To develop subject knowledge at all levels particularly primary and post 16.
- To develop collaborative planning groups to address curriculum or qualification change.

- To enable communication between educational establishments.

(Taken from: <http://www.mathshubs.org.uk/find-your-hub/great-north-maths-hub/>

December 2015)

What have we done?

One of the ways in which the Great North Maths Hub is working towards meeting these aims is through the creation and development of the SEN forum. After the Great North Maths Hub launched and hearing about the work that was happening around mastery and Singapore text books within mainstream schools, it became clear to me that while this work was incredibly useful, there was no work being done to address the needs of SEN schools within the North Tyneside area. An initial meeting was held with the Maths Hub Lead and the Maths Hub Administrator and it was agreed that the first step would be to create a forum. This would allow the SEN schools to have opportunities to meet and discuss issues, concerns and ideas for potential projects. One of the widely acknowledged limitations of working within special needs education is the lack of networking opportunities and the frequency of these, which are nowhere near as well established as they are in mainstream schools. Our first network meeting had representatives from schools that teach pupils with a range of needs including; severe learning difficulties (SLD); moderate learning difficulties (MLD); profound and multiple learning difficulties (PMLD); autism and social, emotional and mental health needs (SEMH). It was so

One of the widely acknowledged limitations of working within special needs education is the lack of networking opportunities

important to me to have all these different groups of pupils represented as their needs are so varied and different - to group them all together as “Special Needs” and have one person make decisions about appropriate projects for all of them wouldn’t be fair.

Since that initial network meeting we have continued to extend and develop the SEN forum, now with even more people from a range of provisions from across the North East attending. One of the most valuable outcomes of these meetings is the opportunity for people to network and share ideas but also to discuss some frustrations and hear that others are having the same issues. This can lead to sharing of information and potential solutions, which was what the Maths Hub aims to achieve.

We have also been able arrange for some specific training sessions, based on some of the needs that were identified from the meetings. Normally within SEN specific education we find we attend courses

that aren’t designed with our pupils in mind and we have to have a “best fit” for our CPD. I was able to deliver some SEN specific training at the Great North Maths Hub

conference and we organised for Les Staves to come to the North East and deliver a special SEN and Maths training session, which was incredibly successful.

What is the future?

There are further SEN forums planned for the future which will hopefully involve including more professionals and experts and further opportunities

to share knowledge and run workshops. One of the issues that is high on our agenda as a group, is looking at ways of developing accurate and appropriate assessment systems. Most of the schools are still using the PIVATS and are looking for ways to show the small steps of progress our pupils make.

Some other projects which are currently being developed and which other members of the forum are helping with include mastery within SEN teaching, developing skills for teaching assistants within SEN and maths through another specific course led by Les Staves and work on curriculum

and functional skills teaching at post 16.

The Maths Hub SEN forum is still in its early stages of development so it is still too soon to accurately assess the impact, however in the little time we have been running everyone involved has had good things to say and I'm very positive that the future is going to bring great things for us.

If you want to learn more about the Maths Hubs, you can at:

<http://www.mathshubs.org.uk/>

Revisiting a rich bank of resources focusing on common errors and misconceptions

Mary B J Clark revisits the *Wave 3 Mathematics resources: Supporting children with gaps in their mathematical understanding*.

These materials originally published by the Primary National Strategy in 2005 were developed during a Wave 3 mathematics pilot with 27 local authorities. Feedback influenced the revision of the teaching materials and their presentation in the pack. The pack provides more detail about the materials and the ways in which they might be used. The purpose of this article is simply to give a taste of some of the teaching materials in the pack and links to where more can be found.

The complete set of materials is freely accessible on both the STEM website and the National Archive as well as on a number of local authority sites.

<http://webarchive.nationalarchives.gov.uk/20110202093118/http://nationalstrategies.standards.dcsf.gov.uk/node/20314>

<https://www.stem.org.uk/elibrary/resource/29225/wave-3-materials-supporting-children-with-gaps-in-their-mathematical>

The materials:

- are aimed mainly at Key Stage 2 pupils, having been designed with age appropriate contexts and approaches for this age group;
- follow the principles for successful Wave 3 intervention that have been identified by

research;

- aim to increase pupils' rate of progress by providing focused teaching activities which tackle fundamental errors and misconceptions;
- are applicable to any pupil who, for any reason, demonstrates fundamental errors and misconceptions;
- focus on the most commonly occurring types of mathematical difficulties with number and calculation.

The teaching materials are referenced by year group to the National Numeracy Strategy Framework for teaching mathematics key objectives, so there may be variations from the year group attributed to particular content in the 2013 National Curriculum. However mathematics errors and misconceptions remain remarkably consistent in classrooms around the country so clearly these continue to need particular attention so that they do not become barriers to progress.

In the Using the Pack book are two tracking charts, one for addition and subtraction and one for multiplication and division. These charts can be used to both to diagnose pupils' errors and misconceptions and to identify teaching ideas for each of the listed errors and misconceptions. They also provide an index to where further assessment and teaching ideas can be found in the 27 booklets in the pack, one for each of the highlighted errors and misconceptions.

The structure of each booklet is similar; they list :

- the error or misconception;
- an opening teaching activity addressing the error/misconception;
- a number of Spotlights (short focused teaching

activities);

- a final Spotlight often encompassed in a game, which includes assessment opportunities, key vocabulary checklist, and reflection on the intended learning outcomes.

It has been challenging to select just one activity to demonstrate the possibilities of this rich resource. There follows one of the activities offered for pupils having difficulty with adding three numbers in a column, except by adding the first two and then the last one. A resource sheet, *Partitioning*, is among the resources for the activity; this is Resource sheet 23 and is provided in the A4 book *Resources and index of games* which is a part of the whole pack of materials. For the purposes of sharing this sample activity in *Equals* the resource sheet is also reproduced here.

To see the whole of this booklet:

Wave 3 (4 Y4 +/-) Teaching activities to help children add three numbers in a column

use the link to the National Archive:

http://webarchive.nationalarchives.gov.uk/20110202093118/http://nationalstrategies.standards.dcsf.gov.uk/node/47029?uc=force_uj

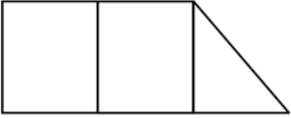
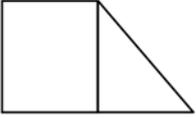
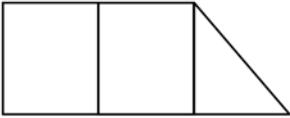
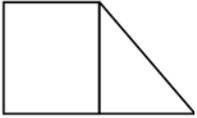
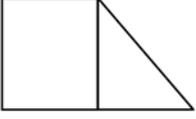
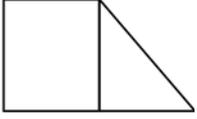
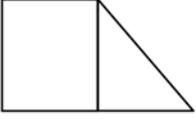
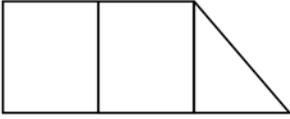
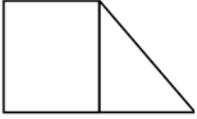
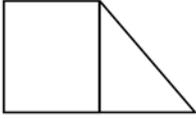
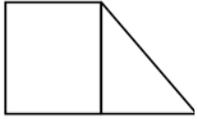
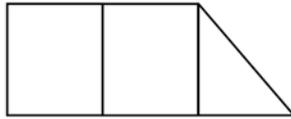
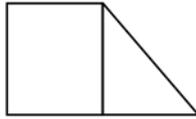
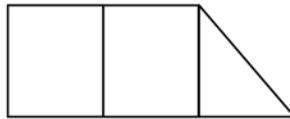
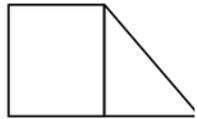
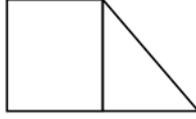
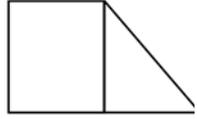
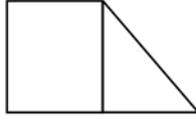
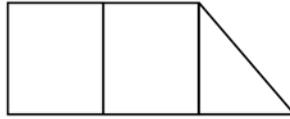
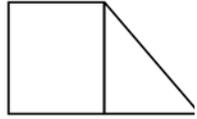
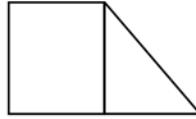
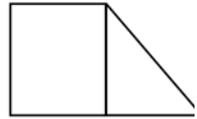
or go to the STEM website:

<https://www.stem.org.uk/elibrary/resource/29225/wave-3-materials-supporting-children-with-gaps-in-their-mathematical>

and find the booklet in the *Addition and subtraction* pdf

Did you know that in 2008 about 150,000 people sought asylum in the EU but in 2015 1,250,000 sought asylum.

Partitioning

 	 
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Spotlight 3

Has difficulty with adding three numbers in a column, except by adding the first two and then the last one

Opportunity for: reasoning about numbers

Why did that happen?

Time 15–20 minutes

Resources

- Partitioning (Resource sheet 23)
- Place value (arrow) cards
- Cards with + signs

Key vocabulary

add	units	estimate
plus	how many altogether?	calculate
column	partition	check
tens	combine	
ones	most significant digit first	

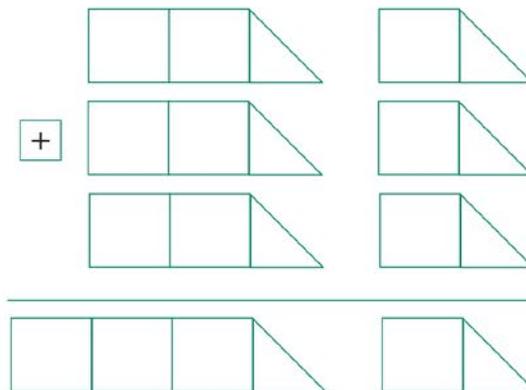
Teaching activity

Explain to the child that this activity is going to help them learn about adding more than two numbers together more efficiently and writing down how they do it.

Ask the child to select three tens place value cards and three units cards and make three two-digit numbers from them, for example 24, 53 and 15.

If you want to make sure the child doesn't have to cross boundaries, you might want to give three numbers rather than letting the child choose, for example 21, 32 and 34.

Ask them to arrange the cards in column format for expanded addition, inserting an addition sign card where necessary (as in the initial teaching activity above). For example:



? How can you add your numbers and find out the place value cards you need to place under the line?

Encourage the child to work as independently as possible but, if they have difficulties, indicate the tens place value cards (and possibly also the hundreds cards) for a first total, followed by the units cards.

Ensure that they recombine to find a final total.

Keep a note of the first total, or you or the child could record the total on *Partitioning* (Resource sheet 23). Ask the child to make three new numbers using the same place value cards. Repeat the activity, asking the child to find the new total.

? What do you notice?

Ask the child to make another three numbers with the original place value cards and carry out the addition again.

When three totals have been obtained from the place value cards, ask:

? Why do the numbers keep adding to the same total?

Focus the child on the fact that the same tens numbers are being used and the same units numbers.

? Will it make a difference to the total if we change the order of the numbers?

? So what do you know about changing the order of numbers when you add?

? Are you surprised by that?

Review - Judy Hornigold

Book review

The Dyscalculia Pocket book by Judy Hornigold

2015. Teachers' Pocketbooks.

ISBN: 978 1 906610 84 5

Part of the comprehensive 'Teachers' Pocketbooks' series, the newly published 'Dyscalculia Pocketbook' provides an accessible and remarkably comprehensive overview of dyscalculia, maths learning difficulties and maths anxiety and suggests how teaching can be adapted to work with these conditions.

I recently had a quick chat with Judy about the book and also the role of specialist Specific Learning Difficulties teachers in the maths classroom.

I asked Judy who the book was aimed at?

This book is aimed at teachers, TAs, and SENCo's, in the primary and secondary sector but would also be useful for parents of children with dyscalculia as well as adults who think they may be dyscalculic and want to find out more about it.

I went on to ask; do you feel that dyscalculia is adequately understood in the classroom?

Understanding of dyscalculia is improving, but it still lags way behind other specific learning difficulties such as dyslexia. More people have heard of the term dyscalculia, although many see it as just being 'bad at maths' or having 'dyslexia for numbers'

The book begins with a short introduction to

dyscalculia and maths learning difficulties, recognising that, whilst there is no commonly agreed definition for dyscalculia, there are some common threads running between the various definitions:

- A presence of severe difficulty in mathematics.
- Being able in other areas of the curriculum.
- Caused in some way by fundamental differences in brain structure.

Four subtypes of dyscalculia are then identified; Core number; Memory; Reasoning and Visual Spatial ability. These descriptions are supported by a number of ways to help each type. It is noted that a learner with dyscalculia may have difficulties in one, two or all of these subtypes.

It could be argued that some of these subtypes co-occur with other specific learning difficulties, for example, Memory with Developmental Coordination Disorder. I am always wary of the risk of incorrect labelling leading to a wider learning need being missed. However, this is a discussion for those undertaking diagnostic assessment or confronted with the unenviable task of determining a definition for dyscalculia that achieves consensus. As a tool for the classroom or for home, these four subtypes work exceedingly well and provide an excellent framework around which we can begin to understand a learner's difficulties.

The second section looks at some of the risk factors that can aid identification. I asked Judy to explain what kinds of risk factors can a classroom teacher or TA be looking for to help raise concerns

maths success. Less reliance on the answer and the procedure and more emphasis on the process and the strategy. Learners with dyscalculia have very poor number sense, they find it hard to understand how numbers relate to each other so time spent on developing this will help enormously.

Judy lectures on Inclusion for Edge Hill University and is an Associate Tutor for the BDA. As an independent Education Consultant specialising

in dyscalculia and dyslexia, she also delivers lectures and workshops throughout the UK and internationally. She has written two books of lesson plans for learners with dyscalculia as well as a guide for parents of children with dyslexia.

Judy can be contacted via her website www.judyhornigold.co.uk

Mathletics from 3P Learning supports effective differentiation and promotes ‘a frenzy of learning’ in the classroom.

Nathan Still is the Technology Integration Specialist at Cairo English School. It is part of his job to train staff so they are confident about using technology in the classroom and can play an active role in educational technology initiatives.

Mathletics was already in use when Nathan started at the school two years ago but his goal was to make sure staff used it to improve differentiation.



Nathan Still

He focused on three specific objectives:

- To help staff to support students who needed extra help with mathematics in class, at home and in learning support
- To use Mathletics to push the high attaining students who were able to work independently and who needed to be challenged
- To support parents, especially those who were not proficient in English, who wanted engaging resources for home use.

‘Differentiating teaching and learning in the classroom is a priority for this school,’ said Nathan.

about a student's dyscalculia and maths learning difficulties?

One of the main ones is a severe lack of understanding of number and this is over and above finding maths hard. An inability to recognise the number of items in a set (subitising) is also a key indicator. Learners with dyscalculia also tend to stick with immature calculation strategies, such as counting in ones and they also find it very hard to estimate.

One of the highlights is the description of the six levels of knowledge required in maths learning. I asked Judy, in the book you identify Professor Sharma's six levels of knowledge required to understand a new mathematical idea; Intuitive; Concrete; Pictorial; Abstract; Application; Communication; Do you feel there is a level where learners who struggle often get stuck? Or perhaps levels that often get missed out?

Many learners struggle because we tend to miss out the concrete and pictorial stages as the children get older. In key stage two the children may frequently be working at the abstract level only. The application and communication levels are also missed out or underemphasised.

Application is important to give context and relevance to the maths and communication will enable the child to make sense of the maths through their explanation and use of mathematical language.

I also found the 'Ten Top Tips' to be useful. I have always stuck by the adage that good teaching

for specific learning difficulties is just 'good teaching'. Therefore, these tips are of value to all maths and numeracy teachers, helping to liven up lessons, promote discussion and develop genuine understanding. So, I had to put Judy on the spot and as if she could pick one tip to share with the profession, what would it be?

Use concrete materials- as many types as you can as often as you can, in a way that supports understanding rather than a counting tool or a crutch to rely on.

Judy Hornigold's track record is impressive. She is one of a handful of genuine teacher experts working with maths difficulties in the UK. Judy has written the PGCert in Dyscalculia and Maths Learning Difficulties for Edge Hill University, which is the first of its kind to be accredited by the British Dyslexia Association (BDA), and the Level 2, three-day course for the BDA. She is therefore in a unique position to explain the role of specialist teachers in the maths classroom, so I asked what could the 'dyscalculia expert', by which I mean a maths

teacher with a specialist teacher qualification, or with extensive experience of dyscalculia, offer to a maths department to help improve teaching and learning?

Many things! Most importantly is the role that concrete materials play in developing our understanding of maths. This cannot be understated. Also, to focus on mathematical reasoning which has been shown to be the most important factor in

Many learners struggle because we tend to miss out the concrete and pictorial stages as the children get

...and it was important that the parents felt involved and empowered.

'It is especially important in an environment with language learning challenges. However, we knew that there was no magic bullet which would meet everyone's needs and it was a cause of anxiety for some of our staff.'

The school was also receiving requests from parents who were looking for good educational resources to enhance mathematical skills. Some found that their children were so enthusiastic that they needed to get onto the next level of Mathletics at home and it was important that the parents felt involved and empowered.

Winning solution

The school wanted a high quality resource which would be easy for teachers to use and make them more confident of their ability to provide effective differentiation to assist pupils at all levels.

3P Learning resources had been used by the school for a long time, especially in the Early Years and Primary departments. Nathan Still was impressed by the excellent customer service offered by 3P Learning so he was happy to recommend Mathletics to teachers.

'The competitive element is very strong in Mathletics,' said Nathan. 'Students can track their personal progress and, when ready, compete against their peers in school, nationally and on a global scale. We have found that competition has been a great motivator.'

'Mathletics engages all the pupils, especially the boys. When you see groups competing with each other in the classroom, there is a frenzy of learning - it's amazing how much they learn.'

Results

The school uses Mathletics in computer rooms, classrooms, on mobile 'computers on wheels', on tablets and for pupils to use at home. The resource portal keeps a log showing how often different

resources are used and Mathletics and other 3P Learning products are the most popular.

Nathan works with the teachers, sometimes one-to-one, assessing

different teaching strategies and making sure they can use the resources confidently. It is effective way of providing training: 'Once they have seen Mathletics, it is amazing how teachers latch onto differentiation. It is a great relief to them to know that they can meet their pupils' needs,' said Nathan.

For a free trial [click here](#) or visit www.mathletics.com. For further information on 3P Learning please visit 3Plearning.com.

The school wanted a high quality resource which would be easy for teachers to use and make them more confident of their ability to provide effective differentiation

In 1975 Viking 1 and 2 became the first successful Martian landers. In 2012 the Curiosity Rover successfully lands on Mars using the daredevil sky crane system. In 2013 India's Mars Orbiter Mission launched while 2018 marks the proposed launch of the SpaceX's Red Dragon mission.