

The Power of Maths Roundtable:

Changing Britain's Perception of Maths



The Power of Maths Roundtable Series



The Power of Maths Roundtable Series

At Pearson, we are committed to empowering confidence and success in maths.

Our **Power of Maths Roundtable** series brings together leading influencers across education, maths and business to discuss and unlock contemporary issues facing mathematics in Britain today.

This report draws upon the insights gathered at the inaugural Roundtable in late 2018, where practitioners and academics joined school, business and third sector leaders to explore how we can collectively transform perceptions of maths both inside and outside the classroom.

Delegates discussed ways to progress the UK's approach to maths teaching with the support of Roundtable host and TES editor, Ann Mroz, and speakers including maths teacher and comedian Kyle Evans; leading academic, Dr Natthapoj Vincent Trakulphadetkrai and maths practitioner, Danielle Ashley.



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Collaboration can drive change



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All sectors need to come together – business, education, and charities as well, to help children.

Danielle Ashley,
Maths Lead Practitioner,
Gipsy Hill Federation

”

The first **Power of Maths Roundtable** brought together a range of leading thinkers across mathematics – from practising teachers to school and business leaders – to discuss the issues affecting maths in the UK today.

The diverse backgrounds of the attendees generated lively debate and fresh ideas for solving problems.

Discussion highlighted how there can be many divisions in maths: between primary and secondary schools; between the

competing demands of exams, teaching for depth, connection and understanding of mathematics, as well as “real-world” skills; and between pedagogies adopted by the UK and other high-performing jurisdictions. These divisions can limit our progress in maths.

The Roundtable discussion particularly drew out the problems that stem from primary and secondary schools working in silos. This can lead to a lack of continuity between Key Stage 2 and Key Stage 3, and a negative impact on children’s progress.

However, the Roundtable also identified plenty of encouraging examples of people and organisations working together to transform the maths landscape. For instance, the Maths Hub programme, coordinated by the National Centre for Excellence in the Teaching of Mathematics (NCETM) bridges primary and secondary, the UK and East Asia, to identify best practice in maths teaching and effect change on the ground in schools.



Collaboration can drive change



In addition, The Fair Education Alliance (FEA), which represents over 75 leading business, education and voluntary organisations, has set out the practical steps that schools and government can take to improve maths understanding and hence results among children from the least privileged backgrounds in their 2017 report (Closing the attainment gap in maths).



Recommendation

Develop third sector support: Explore opportunities for supporting charity groups that could subsidise tutors, alongside other important initiatives, with the aim of narrowing the gap between the most disadvantaged pupils and their more advantaged peers.

This includes a focus on ensuring continuity in approach and practice from early years to primary school, and from primary to secondary school and beyond.

The Roundtable showed that there really is more that unites us, than divides us, when it comes to maths education. Collaborating across education, business and charities can be a catalyst for change.



Recommendation

Develop new collaborations: The Teaching Schools Council and Maths Hubs have worked together to provide the NCETM Maths SLE School Improvement Support Programme. This programme supports mathematics Specialist Leaders of Education (SLEs) to develop their approach to maths school improvement, including aligning with approaches used in the Maths Hubs Programme. It is important to seek further opportunities for collaboration between professional development organisations to drive substantial change over time. For example, The Further Mathematics Support Programme (FMSP) Wales collaborates with the Regional Consortia, providing resources and Professional Development to develop depth and connection, as well as the use of digital technologies in maths teaching.



Recommendation

Build knowledge and understanding between KS2 and KS3: Set a requirement that trainee teachers must spend time across key stages spanning primary and secondary, and find channels that encourage KS2 and KS3 teachers to share curriculum knowledge to ensure continuity for learners.

Showcase the relevance and joy of maths



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Without maths we are so much poorer.

Ann Mroz,
Editor, TES

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Maths is not just a subject studied in the classroom. It is relevant and important in our lives beyond the school gates, whether we are looking to understand our economy and natural world, engage with society or manage our personal lives. Maths can also unlock doors by giving us the tools we need to access new learning (including STEM subjects) or pursue a career that increases our earning power.

In the Roundtable discussions, educators and business leaders passionately advocated that maths is both useful

and important. However, there was also a feeling that maths can be joyful and beautiful in itself.

The Roundtable attendees were concerned that pupils often lose their fascination for exploring maths as they move through a high-stakes exam system that focuses on results and resits. So, how do our young people really feel about maths?



Showcase the relevance and joy of maths



In a Twitter poll, shared by maths teacher and comedian, Kyle Evans, 83% of teachers said they agree that maths is a creative subject but estimated that only 15% of their students felt the same way.

A 2019 Department for Education *Attitudes towards STEM subjects by gender at KS4* report showed that when asked about which subjects were most likely to lead to a future job, 69% of male pupils named a STEM subject compared to 51% of females.

More males (36%) than females (23%) felt that mathematics was most likely to lead to a job in the future; the most common answer for females was English. These results highlight that we face a challenge: showing our young people that maths is both an exciting subject and one that can unlock doors.



Recommendation

Schools and businesses working together to inspire young people:

The CBI believes that businesses can add value to the education system, including broadening and raising pupil's aspirations through career guidance, and supporting curriculum design, delivery and assessment. To implement this vision, they are working with STEM Learning to explore opportunities for teachers' professional development (through the STEM Insight Programme) and working alongside KPMG to support National Numeracy Day taking place on Wednesday 15th May 2019.

One of the objectives of Maths in Education and Industry (MEI) is to inspire more young people to choose mathematics. They are sharing careers videos that highlight ways in which learning mathematics can lead to a brilliant career and delivering Maths in Work CPD to empower teachers to integrate work-related applications of GCSE-level maths into their lessons.

We must build on the work of the CBI and MEI to inspire pupils with the possibilities of learning maths.

Showcase the relevance and joy of maths



During the Roundtable event, business leaders and educators alike came alive when talking about maths. However, it is not enough for a small group to enthuse about maths behind closed doors – we need to find ways to inspire pupils to share our love of maths.



Practical tip

Regularly integrate problems with more than one solution into maths. Ask pupils to work on these problems in pairs or groups, then come back together as a class to debate the strategies used and solutions. Pupils will become engaged in their learning by thinking creatively and participating in rich mathematical discussion, and rather than fixating on the “correct” answer, they will be excited to reason about their solutions.



Practical tip

Use displays in school to showcase the awe and wonder of maths in the real world. Take these displays out of the maths classroom and integrate them throughout the school to reinforce that this wonder is all around us. Twitter and Pinterest are great tools for finding and sharing ideas!



Recommendation

Bust myths around maths: In schools, talk openly about the utility and creativity of maths. Tackle the myth that maths is “right” or “wrong” and the goal is to “get the right answer”. Instead, show pupils that debate, discovery and creativity are an integral part of maths, rather than characteristics confined to humanities, and this makes maths fascinating, beautiful and exciting.



Reduce maths anxiety



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To change the culture of maths, we need to eliminate the “can’t do” attitude...Saying that we’re going to do it is one thing, but actually doing it is the important step.

Kyle Evans, Maths Teacher,
Barton Peveril College,
Maths Comedian and Communicator

”

It is not uncommon for adults to be under confident in maths. They’ll often protect themselves by preempting failure with comments such as, “I was never good at maths” or “numbers aren’t my thing”. Unknowingly adults can pass on their anxieties to children and young people, leading to many arriving in their maths lessons ready to hate it.

Parents, carers and teachers can transform pupil’s expectations and achievement in maths by modelling positive learning traits and a growth mindset. This involves many changing their own attitudes towards the subject and overcoming several challenges: a culture of labelling pupils as “more able” or “less able” in maths; under confidence among many teachers of maths, especially non-specialists in primary and secondary; and the high-stakes exam culture in the UK.



Recommendation

Tackle the bad press: Maths can be represented negatively in the media, from the infamous L’Oreal advert in which Helen Mirren boldly stated, “maths was never my thing” to the often dismissive response of presenters to well-known ‘puzzle of the day’ radio segments. It’s time to confront negative representations of maths in the media and find maths celebrities, like Carol Vorderman, Rachel Riley and Hannah Fry, who inspire young people to enjoy the subject.

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Reduce maths anxiety



Preconceptions about gender in maths can compound these challenges. The latest PISA triennial survey (2015) shows that boys in the UK outperform girls in mathematics by an average of 12 score points, similar to the OECD average gender gap of 8 score points. The gender gap in the UK has remained unchanged since 2012. In England, boys score 12 points higher than girls in mathematics.

Girls are under-represented in maths, and the sector is challenging itself to correct the balance and tackle specific maths anxieties among girls. But what about boys?



Recommendation

Build mathematical confidence among parents: Give parents simple suggestions for engaging their child in learning maths at home, whether it is working on a puzzle book at bedtime, creating a maths picture story book or talking about shape while they play with building blocks. Show parents that they can engage their child in maths talk, no matter their level of knowledge and confidence in maths. By making maths a natural part of everyday life, rather than a topic to be avoided, all parents can encourage their children to be confident mathematicians.

At the Roundtable we asked ourselves: Are there anxieties specific to girls and boys? If so, do we really understand what underpins these fears in order to reduce anxiety for all young people?

Maths anxiety is undoubtedly a complex area. However, it is worthwhile for parents and educators to spend time understanding and overcoming their own anxieties, so they can support young people to do the same and unleash their potential in the subject.



Recommendation

Build mathematical confidence among teachers: Develop teachers' confidence in teaching mathematics through high-quality professional development that spans subject knowledge and best pedagogical practice.

Invest in our teachers



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The message that I've come away with is, it's about the teachers, it's about investing in teachers and making sure that they can teach maths the best that they can. Give them the training, give them the materials – give them everything they need to teach maths the best that they can.

Tony Staneff,
Head of External Initiatives,
Trinity Multi-Academy Trust

”

We've seen how important teachers' own confidence is in building a positive perception of maths among young people. In fact, teachers are one of the biggest influencers on our young people.

They have a crucial role to play in developing their characters and attitudes towards learning, as well as building their knowledge and skills across a range of subjects.



Recommendation

Improve access to high-quality training and resources: Teachers need high-quality tools to help them design and deliver effective lessons. The emergence of new guidance, such as the recommended list of primary mathematics textbooks supporting a mastery approach, can help schools to find high quality resources that are right for their teachers and pupils. However, resources are not a silver bullet and even resources of the highest quality can be misused! Therefore, it is critical to invest in teacher training. We need to give schools practical guidance for freeing up time and budget specifically for continuous professional development. At the same time, schools should start to think creatively about training their teachers in-school, for instance, reducing admin from team meetings to free up time for cascading professional development or sharing high-quality subject knowledge videos.



Invest in our teachers



The Roundtable discussion highlighted that many maths teachers are not subject specialists (particularly at primary) and feel under confident in teaching the subject.

A 2018 Education Policy Institute report *The teacher labour market in England: shortages, subject expertise and incentives* highlighted that there are persistent problems in recruiting and retaining a sufficient number of maths and science teachers. Primary school teachers tend not to be subject specialists, while at secondary level, maths has the lowest proportion of highly-qualified teachers (with as little as 50% holding a degree in the subject).

Investing in training for teachers of maths is an antidote. With training, all teachers can build their conceptual understanding of maths and develop excellent teaching practices for the subject.

High-quality resources, such as textbooks and teacher guides, can help teachers to consistently implement what they

have learnt in the classroom. Worryingly, a recent 2018 *International Summit on Textbooks* report revealed that just 8% of teachers surveyed expect to be using textbooks – one of the best workload reduction tools available – in most or all of their lessons by 2020. This highlights that we have some way to go in supporting our teachers' professional development, as well as reducing their workload.

Budgets for in-school professional development and resources are shrinking; in addition, there is limited time in the timetable for teachers' own learning and development. The Roundtable delegates agreed that steps need to be taken by the DfE to address these issues, building on the Workload Reduction Toolkit and Teacher Recruitment and Retention Strategy. However, until there is a significant, positive shift in school budgets and time freed up for professional development, it is crucial that we all think creatively about how we can develop our maths teachers.



Recommendation

Develop a new culture around professional development:

A collaborative and reflective approach to professional development has the potential to enhance teachers' pedagogical practice and confidence.

Encourage teachers to observe, or even film, lessons and reflect on them with a colleague or as a team. This gives an opportunity to reflect on best practice, build subject knowledge and share new ideas. Although it may seem daunting at first, encouraging a more open culture around learning within the profession will develop teachers' own confidence as well as encouraging pupils to think about their own learning.

There is space to innovate in maths teaching



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What's coming out of this event is a perception in my mind that we've really got to get to grips far more with how mathematics is taught in classrooms...moving towards teaching that is far more conceptually-based and that is supported by a very effective pedagogy. That's really at the heart of what I think we need to do.”

Vanessa Pittard,
Deputy Chief Executive, MEI

”

The Roundtable discussion surfaced several different approaches to teaching maths: teaching for mastery, teaching maths through stories and cross-curricular maths.

Teaching for mastery

The DfE's Teaching for Mastery Programme (led by the Maths Hubs and incorporating the UK-Shanghai teacher exchange, creating a cadre of Maths Specialists, Work Groups and match funding for high-quality textbooks) has moved mastery to the forefront of conversations about maths teaching. Maths educators are developing and refining their understanding of what mastery looks like in the UK. On the ground, the process of implementing mastery in schools is one of evolution, not revolution.

We've already seen that there is a disconnect in mathematics teaching as children move from primary to secondary school. In the mastery space, too, there is a disconnect while maths educators develop a clear picture of how mastery works in practice at KS3 and KS4. However, the big ideas of mastery (learning in coherent and connected small steps, fluency, variation, uncovering mathematical structures through representations and understanding concepts deeply through reasoned mathematical thinking) span primary and secondary. In this way, could mastery provide the foundations for greater continuity between primary and secondary?



Recommendation

Tackle the barriers to mastery: Teachers need professional development (including developing their subject knowledge and pedagogical practice) and high-quality resources in order to teach for mastery with confidence and consistency. This will ensure that the benefits of a mastery approach can be realised. It is also important to tackle the biggest unresolved questions of mastery, including what does mastery look like at secondary and how does this link with mastery at primary?



There is space to innovate in maths teaching



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I want to get people to see the power and value of using story picture books in maths teaching, particularly getting students to create their own mathematical picture books...

Dr Natthapoj Vincent Trakulphadetkrai,
Lecturer in Primary Mathematics
Education, University of Reading

”



Mastery involves a change in mindset, training and classroom practice. However, it has the potential to improve the quality of teaching and learning, and therefore the improvement in outcomes could be significant.

Maths through stories

Mathematical story picture books, such as Cindy Neuschwander's *Sir Cumference* and *the Fracton Faire* and *Bean Thirteen* by Matthew McElligott, focus learners' attention on a single concept and explore that mathematical concept from several different angles.

Research shows that by engaging with the story, children develop an ability to visualise mathematical concepts, represent concepts in a number of different ways and make connections between those representations. This makes them more confident problem-solvers. Children can extend these

skills by becoming the authors of their own mathematical stories.

Story picture books need to be selected with care, to ensure they are relevant to the topic being taught and suited to the learners.



Recommendation

Experiment with innovative teaching strategies: Encourage more teachers to try teaching a new mathematical concept or a complex maths problem using a story picture book. (MathsThroughStories.org is the perfect starting point). You could also develop cross-curricular projects that allow pupils to apply the skills they learn in maths to a range of contexts. Nurturing a culture in which teachers are confident trying new approaches paves the way for reflection, innovation and continual improvement.



There is space to innovate in maths teaching



This includes considering the diversity and inclusivity of the book. Research conducted by Dr. Natthapoj Vincent Trakulphadetkrai has shown that male characters have 1.48 times more dialogue assigned to them than female characters. This evidence is a cause for concern in a context where fewer girls than boys are choosing to take A-level Maths. If story picture books are being used with impressionable learners, it is important they are inclusive and start to tackle gender stereotypes.

There is a clear synergy with teaching maths in primary schools, as exploring maths through stories is a fun, engaging approach that ties into children's emerging literacy skills. In the Roundtable discussion, delegates challenged themselves to think about how maths stories could be used in a secondary school context. For instance, there could be a place for this approach at A-level as problems become more complex and contain a strong narrative.

Thinking more openly and innovatively about how we can engage young people in understanding new concepts and challenging problems could pave the way for deeper mathematical thinking for even more learners.

Cross-curricular maths

Maths can be more siloed than other subjects. Teachers report that they find it challenging to make links across the curriculum, even with other STEM subjects such as Physics. Some primary schools are choosing to break down this silo by adopting a topic-based curriculum and focusing on developing cross-curricular links. Indeed, this is the direction of travel outlined in the draft Welsh curriculum.

Highlighting maths skills that can be transferred across the curriculum (including creative thinking and problem solving), finding relationships and identifying how maths can be applied, will

show young people that maths is not a separate entity to be studied in isolation. Rather, it is part of a multi-way process in which they apply maths to other subjects to enrich their understanding and, importantly, apply other curriculum subjects to enhance their understanding of maths.





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One of the key takeaways would be how human maths is as a practice. How it's human and emotional to learn, and also to teach, and outside of school it's also got many human applications.

Josh Lury,
Maths Consultant and Author,
Power Maths

”

At its heart, the Power of Maths Roundtable was about people in mathematics: how people with diverse backgrounds and interests in maths can come together to collaborate and drive change; how we can inspire young people with the power of maths (its utility and beauty); how we can develop confidence and encourage a positive perception of maths across society; and how we can support teachers to develop the very best practice.

The Roundtable conversation showed that maths cannot be separated from the people who teach, learn and use it. It is a human practice. It's important that we reflect on the recommendations that came out of the discussion and take concrete steps towards effecting changes that will benefit teachers and young people today, and change how maths is used and perceived in future.

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If all of our staff were modelling the traits that everyone's modelling today at the Roundtable in terms of being positive about maths, if all of our young people were in an environment where those attitudes were prevalent in the classroom, I think that in itself would be a multiplier to help young people achieve a better understanding of maths in the world.

Rob Carpenter,
CEO, Inspire Partnership

”



To join our Power of Maths community and follow the conversation, please visit pearsonprimary.co.uk/powerofmaths





Key organisations

[National Centre for Excellence in the Teaching of Mathematics](#)

[MathsThroughStories.org](#)

[White Rose Maths](#)

[UK Maths Trust](#)

[Catch Up Education Charity](#)

[National Numeracy](#)

[Association of Teachers of Mathematics \(ATM\)](#)

[Power Maths – whole school mastery programme from Pearson](#)

[CBI](#)

[MEI](#)

[TES maths teaching ideas](#)

[Nrich Maths Project](#)

[Teaching Schools Council](#)

Mastery information

[Maths Hubs](#)

[Department for Education Teaching for Mastery programme](#)

[Maths Hubs textbooks](#)

Reports of interest

Trakulphadetkrai, N.V. (2018). Story picture books as a mathematical teaching and learning tool. *Primary Mathematics*, 22 (2), 3-7

[Dominic Oakes 'Connected A Level Programmes of Study' \(pg. 100-103\)](#)

[Longitudinal evaluation of the Mathematics Teacher Exchange: China-England Final Report \(2019\) Sheffield Hallam University and Department for Education](#)

[Key points arising from the International Summary on Textbooks: Textbooks, attainment and reducing inequalities 2018 \(Department for Education, Cambridge Assessment and the Royal Society\)](#)

[CBI and Pearson Education – Helping the UK thrive \(2017\)](#)

[The Fair Education Alliance – Closing the numeracy attainment gap \(2017\)](#)

[Enigma Mathematics Hub; Dr Clare Lee \(2016\) Developing Mathematical Resilience: Teachers' reflections on working to develop mathematical resilience in learners](#)

[Tim Oates \(2014\) Why Textbooks Count](#)

[Education Policy Institute – The Teacher Labour Market in England, Shortages, subject expertise and incentives; Luke Sibbets \(2018\)](#)

[PISA triennial survey \(2015\)](#)

Free resources

[Handy Little Guide to Mastery](#)

[Handy Little Guide to Growth Mindset](#)

[A Leaders Journey to Maths Mastery](#)



Thank you to the delegates who attended the inaugural **Power of Maths Roundtable** for helping to shape this report:



Ann Mroz	<i>TES</i>
Kyle Evans	<i>Barton Peveril College</i>
Dr Natthapoj Vincent Trakulphadetkrai	<i>University of Reading</i>
Danielle Ashley	<i>Gipsy Hill Federation</i>
Rob Carpenter	<i>Inspire Partnership</i>
Dr Clare Lee	<i>Open University</i>
Dom Murphy	<i>University of Northampton</i>
Jacquelyn Lomas	<i>Harris Federation</i>
James Howard	<i>Northern Education Trust</i>
Charlie Gilderdale	<i>University of Cambridge, NRICH Mathematics Project</i>
Alison Kiddle	<i>University of Cambridge, NRICH Mathematics Project</i>
Dominic Oakes	<i>FMSP Wales</i>
Tony Staneff	<i>Trinity Multi-Academy Trust</i>
Josh Lury	<i>CODE Maths Hub</i>

Marcus Fleet	<i>Berkhamsted Preparatory School</i>
John Cope	<i>CBI</i>
Jonathan Johnson	<i>Teaching Schools Council</i>
Vanessa Pittard	<i>Mathematics in Education and Industry (MEI)</i>
Dr Julian Gilbey	<i>Association of Teachers of Mathematics</i>
Ian Hibbert	<i>Oswestry School</i>
Andy Taylor	<i>University of Worcester</i>
Alexandra Riley	<i>Pearson</i>
Steve Besley	<i>Pearson</i>
Berwyn Jones	<i>Pearson</i>
Vicki Gardner	<i>Pearson</i>
Lindsay Nadin	<i>Pearson</i>
Vanessa Wright	<i>Pearson</i>
Rebecca Rosenberg	<i>Pearson</i>



This report is written by Alexandra Riley

Alexandra is a senior publisher in the Primary Maths team at Pearson and leads the team behind Power Maths. She has over 10 years' experience working in educational publishing with subject experts, practising teachers and leading mathematics organisations.



The Power of Maths Roundtable

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