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Hello everybody, my name is Jenni back, as I suspect you know because you're expecting to see me. Big welcome to all.

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This is a first attempt by the Mathematical Association to run a webinar, so we'll see how it goes.

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I would like to welcome you all and thank you very much for joining in with this.

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If you want to ask any questions, then please feel free to use the question button on the side or chat, and I'll see those questions.

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I'll take all questions at the end because otherwise things will get complicated.

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So this is really to launch my new book, which the Mathematical Association has kindly published for me.

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It's about a project that I engaged in with a primary school in Brighton.

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My connection with that school came through my work with Nrich.

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Initially, I was down in St Martins, helping Lynn McClure to develop and deliver a day of in service training for the school based on Nrich resources.

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During my time there, I got into conversation with Alex Wingham, who was then the deputy head, - now he's the head of the school, and he expressed an interest in what I was talking about, and I told him about the work I had also done with the University of Plymouth and the Mathematical Enhancement Project, the primary project there.

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Whilst I was working for MEP, I had made some research visits to Hungary and gathered lots of data about how the Hungarians work with young children to induct them into mathematical thinking and reasoning, which is a very different style of approach to the approach of Nrich who I've also worked for.

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So, at that stage, I was trying to reconcile those two approaches. And Alex became interested in my ideas and joined me on a study trip to Hungary.

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Having seen what they were doing there, he became more interested, and the school at that stage was seeking to motivate and inspire children to learn. It's an inner urban school in a part of Brighton which is not leafy suburbs at all.

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And the children come from backgrounds where there isn't a lot of positivity around mathematics, and the staff were struggling to make it interesting and motivating for the children so that they could make sense of it.

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And as a result of that, we developed a collaboration, and that went on for over six years. It still continues, although at the moment, is rather on hold because of this virus.

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But between us we've developed an approach to teaching and learning mathematics based on both the resources of Nrich and the resources from MEP and my own ideas and research I've done elsewhere.

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Initially, we had to make some decisions about what our approach should be.

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So, the National curriculum was about to come in. We knew it would be more demanding. We didn't quite at that stage know the scope and content but we just made the decision that the school would spend longer studying each topic and focusing on motivation initially, and making connections between different subject areas. And really, Alex, suggested the actual structure for each segment of work – this was his inspiration. So we developed a structure for each segment of work with the whole school, working on the same topic at the same time. It's a one form entry school, and that meant it was easier for teachers to have conversations about their maths teaching as we progressed.

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So we split the whole curriculum up into 12 subject areas, which coincide with the 12

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different themes of the math of the national curriculum, the mathematics content, and those were, as you see, the number sense and place value measurement: time and money; addition and subtraction; the geometry of properties of shapes; multiplication and division, measurement: length, mass and volume; fractions, decimals

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ratio

and proportion; statistics; number patterns and algebra; geometry: the position and direction stuff; problem solving; and then consolidation, because everybody needs to have end of year tests and so on. And you need to really cement stuff at the end of the academic year. So, those 12 segments became half of a half term each, so that could be anything between 2 and 3 weeks in length.

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In each module, we also developed a structure.

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We started off with that what we describe as a tantalizing hook, which constituted a meaningful context in which the mathematics we were trying to engage the children with would be raised.

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So we use this partly as a way of assessing where they were at and how much they knew already, But also as a way of saying, look, here's a problem which we think is interesting and the children latched onto that problem because they were chosen to be motivating and interesting.

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And now, we're going to go off and do some mathematics. Learn some mathematics, so that you can tackle the problem.

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We also use mind maps, and sometimes an initial assessment task.

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So we made quite sure that every module we were teaching, we started working with the children where they needed to learn. So we weren't teaching stuff they knew already, and we weren't teaching and stuff that just went straight over the top of their heads.

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Um, from there, we went on to direct teaching and mastery of skills. So that is much more didactic in its approach.

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Transmission based teaching, structured exercises, that sort of thing. But linking back to the meaning of the hook task and often revisiting the hook task after that.

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And that loop of doing something motivating, problem solving, inspiring, meaningful, and then going back to teaching some routines and procedures that the children need to master in order to cope with the mathematics; that loop carried on for as long as necessary.

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Carries on I should say, because we're still doing it.

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We then looked at applications if the topic wasn't particularly applied, we would go on to look at applications more specifically. With addition and subtraction, that might be word problems, but it could also be other kinds of practical or real life problems.

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We might also look at applying the mathematics in the realm of measurement.

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And we'd often make connections with other subject areas, so we might connect back to other topics, other modules that we dealt with previously.

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So, that was a way of keeping everything on the boil through the 12 modules. Because obviously, if you deal with number and place value in September and don't talk about number and place value at all through till the next September, retention is going to be an issue. So we kept working on that.

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We then elaborated the mind map so that that became a memory jogger for the children.

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To look back on and see what they had learned. And then we created memory joggers, as well, which they kept in their maths packs.

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all the children in school have an A4 zip folder in which they keep special bits that put both their equipment that they each have individually and also, there are memory joggers on each topic. And they do that in a way that's meaningful to them.

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We then went on to look at assessment. So we would do some kind of formal assessment at the end of each 2 to 3 week block but perhaps only a couple of questions.

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Then finally, because we felt this was really important, we would have some kind of sharing event to applaud what the children learned and help them to feel positive about the progress that they made.

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And that sharing event might involve another class.

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So they might work with children in the adjacent year groups. So year five might work with year six, and there will be reciprocal arrangement. So, that year 5 worked with year six on something year six had set up, and year six worked with year five, something they'd set up.

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So, that would that meant the children could share.

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and, and celebrate the mathematics they'd learnt, but also we often inviting parents carers, to some event, linked to it.

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So in the module that we do on time and money, the second module, the focus is on working with different businesses in the community, and the children create some kind of shop.

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Which we then invite the parents to join in with. Some of them have a cafe, some of them have a charity shop, and they do things with that to raise money for their school's chosen charity.

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And I'm going to focus now on the work on Fractions in the book, that's on Fair Feast, because at the moment, as some of you will no doubt know, Sue Gifford, Rose Griffiths and I are working on a fractions project with funding from the Nuffield Foundation and managed by University of Leicester (details here <https://www.nuffieldfoundation.org/project/teaching-fractions-and-decimals-to-children-aged-3-to-11>) .

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And so fractions is my current obsession.

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So that's why I focused on the fractions, for this activity for the whole school, and this includes key stage one, although Key Stage two is the only work covered in the book.

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We start off with a problem Fair Feast, which is a problem I wrote with Liz Woodham when I was working with Nrich, and it's about sharing a picnic.

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And you will see in that there are a number of different things to share.

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There are quantities that can be shared in different ways, and that's quite deliberate. And by doing this with all the classes from Year one right through to year 6, we get a tremendous range of responses, and it takes children into all sorts of different understandings of fractions. So it can be a really rich task couched in the right way, But we do at St Martins get children doing it practically with food because that's fun. And they really enjoy it.

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Here you can see some responses that are not actually from St Martins there from taken from a project that I was involved with, with Keith Ellis in Leicestershire.

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And it shows how this Fair Feast task in this case, it was 83 grapes needed to be shared between six children.

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So one of the things, quantities of food they have was 83 grapes.

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And a group of year six children had worked this out in different ways. So one group had said, you get 13, remainder five.

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The other great group said.

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And so that's 13 and 5 sixths, and the other group had chopped up the grapes, as you see in the picture on the site there.

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And that shows the grapes all chopped up into halves, and then into quarters and then into 12ths.

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And they'd worked out that they needed to have a half and a quarter and a 12th of the grape for each of the six children.

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And so an argument ensued about whether this was the same as $\frac{5}{6}$ ths.

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And that led them into the addition of fractions, which they worked out more or less from first principles really. As you can see, the diagram on the right of the child's work is a little flaky, you can see the gist of what they're trying to do.

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So a rich task, which has a range of responses, because it is accessible to loads of kids, is a really good way of motivating, children, to engage with the topic.

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So for the mind maps, and vocabulary, which is all listed in the book, we use the Strategies vocabulary booklet, which you can still access.

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And, in my PowerPoint, I've got links to all these things, which are available.

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these can be the basis of a reference to the new curriculum.

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With the Mind Maps: they were created, either as a collaborative effort, on behalf of the whole class, with the teacher, or, in small groups, or in pairs, it just depended on what the teacher felt was appropriate in relation to the topic.

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That is still carrying on, and we use that partly as a prior assessment, to see where the class is, and what their knowledge of the topic is.

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In the direct teaching, we still do a lot of practical tasks. And one of the practical tasks that we use is the Naming Game.

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This is an example shown with Cuisenaire Rods.

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If you look at the Cuisenaire rods on the left, what you're starting off saying is that an orange and red is going to be one unit.

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I've separate them out in that photograph, but the children would build them close together.

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I've separated them out and labelled them, so you can see more clearly what the gist of what we're doing is, That means the dark green road, which you can use two dark green roads to make that orange and red.

16:02

Each of the dark green roads is a half.

16:06

And each of the pink roads, or purple roads, is a third. Each of the lime, green roads is a quarter. Each of the reds are a 6th and each of the Whites a 12th.

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And so the naming game follows a form of words. If this is a one then this is a....

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And the children get quite creative with this and it starts to lead them into looking at equivalent fractions. In a way it's building a fraction wall.

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and was a precursor to building a fraction wall.

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We also use the MEP resources for many of the modules

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for much of the direct teaching and in the book, I have listed different aspects of each topic and shown tables of where you'd find appropriate lessons.

17:03

All the lessons have a lesson plan, which is supposedly takes 45 minutes, but I've never managed to teach one in under about an hour and a half.

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The Pupil Practice Book, which is a straightforward book exercise which children can fill in with their answers and some copymasters which you can use to project onto a screen.

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So here's an example of the beginning of a lesson plan just to give you a bit more of a flavour of it.

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And you can see that at the top there, it shows you that it's a year 4 lesson. The MEP resources are quite demanding and I would say you can generally speaking go a year or even two years lower than the suggested year. But it depends what you want the exercise for. So you need to look at that carefully.

18:07

The lesson plan here deals with three aspects.

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It deals with fractions, fractions of quantities, which is labelled as R as you see at the top there, it deals with addition and subtraction of fractions which you can see as C at the top there and it deals with problems.

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So the R is revision, it's covering things that have already been covered in the MEP scheme so far.

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The C, the core part of the lesson is, is the C part. And the final part E is Extension.

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The expectation is that the whole class will do the whole lesson together, but that individual children may not get to the end of each task. And then they will only see what the outcomes were if they struggle with it, but because it's a whole class lesson, and they will see other children's success with it.

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And so it's based on whole class interactive teaching if you want a label for it, So that, lesson as well as that bit there, which is dealing with fractions of quantities, for instance, a third of 96 meters.

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It also covers finding a whole from a part of the shape, subtracting fractions, equivalent fractions and word problems. So there's a lot of meat in all of these lessons. And they do need looking at carefully, but hopefully the guidance that I give in the book gives you more of a way to navigate the lessons, than you can find elsewhere.

19:52

After that, we might link back to another hook. And the one that we've linked back to here is Chocolate Bars, which is an Nrich interactive problem.

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which you can try online, it does things on the screen. So, the problem is, you've got these chairs, one bar of chocolate on the first chair, two on the second, three on the third, and five friends coming to our party and first of all one child arrives, which chair will they choose, and it carries on like that. So again, and motivating context involving food again, but I make no apology for that.

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So applications.

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An example I give in the book is an applications problem related to shopping and it's called 'Are you a smart shopper?' and it looks at three different shops, some of which you've got money off, some of which have got extra quantity for free. And some of which you've got, buy one, get one free, and working out what's the best deal on that basis.

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That also links into percentages, the top one, 50% of the biscuits, and so on.

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so, there are plenty of suggestions for applications.

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And after that, we go back to looking at Assessment and revision, creating memory joggers, Revisiting the mind maps, and choose choosing and using appropriate assessment tasks.

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So, and then finally, with the sharing event in fractions, we got pairs of children in Year three, working with a year four child, use cuisenaire rods to add fractions together.

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Years 5 and 6 played the decimal place, a fun game.

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I haven't actually touched on the decimal part of the chapter. But there is a lot more detail given about that in the book.

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The decimal place value game involves children with large cards, with single digit numbers put on them.

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A decimal point, which we represent using a tennis ball, affixed to a fixed point and chairs either side of this.

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and children with digit cards stand either side of the decimal point, and their friends tell them, which way to move, if you multiplied by 100 or divide by 10, or whatever. And that is considered to be great, fun.

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Usually gets everybody very excited, but it's a way of getting years 5 and 6 to play together and share their learning.

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So looking at some of the research background to this, The reason that I'm so impressed with and keen on the project and felt that I should share it in the form of a book, was that we really have developed a community of inquiry in the school in Brighton at two levels.

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Both, within the classrooms, in terms of the progression, of the program of mathematical study with the children, the children talk to one another. They're engaged meaningfully in conversations about the mathematics.

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But, also, I think, quite significantly, within the school, in terms of the teachers' inquiry into effective mathematics, teaching and learning, we do this because everybody's working on the same subject area, same time.

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And that means If they're struggling with teaching some particular aspect, they know the other teachers in their school may also be struggling to teach that aspect. And so, because they're all doing the same thing for a sustained period of time, they can talk about how they've addressed it.

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They talk about the results for their children, the responses of their children to the tasks. And they talk about the mathematics that they're studying with the children.

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Um, I suppose it has to come with a bit of a proviso, in that a level of expertise has been built with sustained support from me for over six years.

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So, it may be harder to do if you don't have that kind of support, I suppose, but I think it says a lot for that kind of 'expert other' approach.

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And I do go into working with them, very definitely, as we are both experts, the teacher who I'm working with, who I do, shared planning with and myself. They know their children, They know where they get stuck.

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All I can do is bring to them some of the maths resources and research that I've studied over the years.

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It's based on design research principles.

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Malcolm Swan's, principles for the design of teaching involves active learning that challenges and thinking and misconceptions.

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We've developed this effective program of study on an iterative basis, trying sequences lessons out with the children, looking at the responses, and developing them further in successive years. Initially, we erred on the side of, lots of enthusiasm and not enough direct teaching really.

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And we certainly change motivation, but we are now being a bit more circumspect and careful about what we do really because we obviously need to deliver in terms of the children achieving what they need to achieve rather than just having good time.

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But I think the fact that, after a couple of years, the most heavily subscribed After School Club, what's the Maths Club, rather than football says quite a lot for what we're doing.

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Teachers now say they're more confident in their approach to teaching maths and , they, the teachers, feel it's one of their favourite subjects now, which was not the case. We've had a lot of staff changes, not huge numbers, but, actually, the kinds of changes you'd expect over a six year period.

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The results in mathematics had previously been lower than for English, but they now exceed them. So English is now the focus. But I think, you know, there's good stuff there that we're trying to build on.

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And Ofsted when they came in 2015 gave the school notice to improve, which was, that was a year after I'd started. Not quite sure why, but they did, but they revised that a year later to Good.

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And thus, the ...

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School is now meeting age related expectations in Sats tests, not that that's the only measure but it's significant.

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If you want to follow up any references at all, you can find all the resources on the MEP website and the Nrich website. And as I say, there are lots of links in there.

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I would also refer you to Jaworski: learning communities in mathematics, and Malcolm Swan's work, as well, which admittedly was for secondary in design, but the principles hold right through the age range.

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Thank you all for joining in today. I will take questions in a minute.

27:50

And a big thanks, especially to Alex, and all the Staff and children at St Martins and the Mathematical Association for letting me do this webinar and for publishing the book.

28:04

If you want to buy the book, the link is on the PowerPoint, and I'm sure you can find it anyway.

28:09

Thanks also to my son, Johnny, who did the photography for the book, and I will now take questions.

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Are there any metrics collected? says Rajiv.

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And, um, I have got some metrics that I could share with you in principle.

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But they're only broad brush, But I'm sure that Alex Wingham, the headteacher would be happy to answer any specific questions.

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And then Capstone asks, What does the problem solving unit looked like, and why is it a separate unit? And the reason it's a separate unit, is, because it gives us a chance to do revision in a meaningful context.

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And basically it's more of the same, OK.

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Enrich problem's, lots of other approaches to solving problems of all kinds and we talked about some of the big ideas, which we were trying to get across.

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Each teacher had an individual amount of time with me at the every module.

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So we started.

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And so they got some individual time doing broad brush planning. Not lesson by lesson planning by any means, but some broad brush planning of the modules. And we did some of those with two year groups together so years 3 and 4, and years 5 and 6, might do some planning together.

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And that facilitates the conversation, also, because everybody's working on the same topic, the same sorts of things that are coming up.

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And so, conversation's happened.

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It's a small school, small staff, and they are very friendly bunch, and they do talk about what they're doing a lot.

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What was the thinking behind each unit being the same length?

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Well, we basically, we tried to divide the curriculum up into chunks that would take roughly the same length, so it wasn't so much, um, each unit being the same length as each chunk being the same length, really.

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So there's a lot of measurement.

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two units of measurement, but the units on measurement offer you a context in which you can revisit addition, subtraction, multiplication, division, fractions, decimals, all sorts of other things. So, you know, that we felt that time was worth spending on that. So they're all connections being made across topics all the time.

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33:01

For that, just having a look at some more questions that I can now see, the most of that's good. I'm probably taking them in reverse.

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And then, a comment from Keith Ellis, who was the teacher I worked within Leicester

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Oh, it's best to share!

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And he says he is interested in the memory joggers in the project.

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Yeah, that's interesting. He says, How did this developed through the research and wasn't always a plan to include these, or did they develop over time? They will always have this idea which we started off with if the children having maths packs, where they put key things in, things they need to hang on to.

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And so that, um, was the prompt for it. The phrase Memory Joggers is definitely Alex Wingham's. I'm sure it's not mine.

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But we felt that trying to develop a few key examples, that encapsulated the main thrust of the module was helpful.

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And, it did develop over time.

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Sometimes, they're not done as well as other times, it does depend on the teachers, and the class, and the amount of time available, But we still feel that, that's pretty important.

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So I hope that answers that one.

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Townsend says, In the book is the planning for all year groups, and all topics available? There isn't this goal but rather

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what we would call a module overview, but not listed by year, just some broad brush suggestions. There isn't specific planning, and we weren't seeking to offer that.

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We think that, that needs to be developed with the children in your class, at the time, in response to their responses to the initial prompt.

36:02

Chris Walker has said, 'I'd like to smash research at the primary school where I work as a TA. Not huge enthusiasm for this, from the school. Any tips, please.'

36:16

I think what I would say is, ask if you can try something interesting, A rich task, like Fair Feast say because we were talking about that earlier, with a small group of children.

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Keep an account of their responses to it, and share that with some other people. And you may find you can generate some enthusiasm through that route.

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Very good luck. I hope you succeed because I started off my research.

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as a parent helper in other people's classrooms and got completely hooked, so good luck with that, Chris!

Ah, What are the differences of approach in a Hungarian school, compared with Nrich.

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Hungarian, the MEP scheme, is a very, very structured scheme that is about, um, methodically building, very sound, mathematically on prior mathematical knowledge and laying very firm foundations.

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Having said that, many of the questions in the, um, lesson plans and in the pupil books are quite problem solving based

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And they're not necessarily routine tasks that you can answer very quickly following a very straightforward procedure. They all demand thinking.

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So, that's one of the reasons why I feel quite, um, happy to advocate both of them, because I think there's a need for fluency, We need to be able to do mathematical procedures, that's part of the game that we play in teaching primary mathematics.

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But we also need to keep children enthusiastic and interested, and I think that probably the two approaches major on one or the other, and the combination of the two is a good thing. That's certainly what we're suggesting in my book and at St Martin's.

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And then a long question from (unclear name), which I will read in full, because it's: What do you recommend as a balance between direct teaching and learning by problem solving? In other words, have you changed the amount per unit of work. You've taught the concepts directly compared to the amount of time spent embedding, these skills in contexts.

39:00

I think we go at it the other way around, in that we start off with a problem, and so problem solving is not an add on thing that you do, at the end and is a context setting thing that you do, at the beginning and refer back to all the way through. I think it's that joined up approach. That is particularly beneficial.

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So, I suppose what I would say is we're advocating, not problem solving, or direct teaching but combination of the two that enables children to use the mathematics.

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They learn through direct teaching and practice to solve a problem that they feel motivated to engage with.

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Janine Blinker, also has a question. Thank you.

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'Great that the school felt able to commit for this longitudinal work as it is so much more effective than doing things for a short time. How did that happen?' It happened because of the enthusiasm and commitment of the staff at the school.

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It's a small school without big budgets. They elected to spend their money on my time to support them in their teaching and learning.

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The leadership team are investors in people is what it boils down to, rather than investing in quick fix approaches that might sort it superficially more rapidly. And I think that's it.

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It is thanks to the school and their commitment, that this was possible, and it does take a long term commitment to see this happen.

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Um, how many assessments do children do each year?

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Um, yeah.

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Malcolm Watson asks, one pre, one post for 12 units, sounds like a lot of testing time. We don't do the testing overtly necessarily at the end and beginning of every single unit. But the initial task can be used as a prior assessment. What all teachers are engaged in is assessing children and the way they're engaging with work the whole time. I'm not suggesting this is formal, and lessons are lost, doing it. It's informal assessment, very often, that goes on in the process of teaching and learning.

41:41

Um, then Rajiv asks about virtual food versus real food. I beg for real food every time - once the children have had the experience of the real food.

41:57

That's got to be real. There's a big difference between a picture of a pizza or a picture of a chocolate bar and actually chopping up the chocolate bar is much more appealing and memorable.

42:09

Was there a specific emphasis on habits of mind in the problem solving tasks, either as Enriched described them or otherwise?

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I'm not sure we did that overtly. I was certainly very well aware of the work that Nrich have done.

42:27

And we do talk about in the consolidation and problem solving chapter at the end, which is really sections 11 and 12 of the programme packed in together.

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We talk about, what makes a good mathematician as part of that. So, we do that at the end of every year.

43:07

What helped me to identify the Hook question, says Pria Shaw, I suppose, because I know a lot of stuff, but sometimes the questions did come from the teachers but not all.

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By any means, you can look for great Hooks on the Nrich website.

43:26

How much of my time has been committed? Oh. That's huge.

43:33

Um, oh, well, to start off with, I was going in to the school for a couple of days, every three weeks. It, since, dropped down to one day each half term, but I spend time with individual teachers, and I think that commitment in the individual teachers, That is important.

43:55

So, thank you very much, indeed, all of you, for all your contributions and a really interesting set of questions. And obviously, I hope you rush out and buy the book, But whatever you end up doing, enjoy your maths teaching, and I hope your children, enjoy their learning, too.

44:15

Bye for now.