The NCETM Maths Podcast Episode 78

I Can't Do Maths - Part 2

Julia Thomson: Hello and welcome to the NCETM Maths Podcast. I'm Julia Thomson [JT] from the NCETM Communications Team and this is Part two of my conversation with Professors Alf Coles [AC] and Nathalie Sinclair [NS] about their book, 'I Can't Do Maths! Why children say it and how to make a difference'. If you've not listened to Part one, I would start there first.

If you're still with us, then let's dive back in.

JT: So, we now come to the next dogma. I found this one really, really interesting, which is that maths is culture-free. It was one of the most interesting chapters in the book for me because it just got me thinking so much and looking at things from a different perspective. Can you tell me a little bit more about that dogma?

NS: In a way it's fascinating that this is an unusual idea that maths isn't culture-free, because maths is done by people and people cannot extract themselves from culture when they go into their offices and do their math.

So, in that sense it's funny, but it's true that we do similar things around the world around mathematics. We share more or less the same number system and talk about shape and so on. So, one of the things Alf and I write about is, yeah, it does seem like it's everywhere, sort of more or less the same. And there's certainly what we would call sort of a fantasy that mathematicians have that what they've created is sort of universal. I think people who love math kind of love that idea. And who wouldn't, you know, that you created something that works all the time, everywhere, forever.

That would feel very empowering. But that sort of ignores, for example, how mathematics is communicated. So, we talk in the book around language and the various ways in which different languages express mathematical ideas that have so many different kinds of connotations. And we talk about gestures as well, which is another aspect of communication, and how these are very different across cultures and can be mobilised in different ways. And we also talk about how mathematical ideas have ideological and aesthetic connections to them. So, there is no real world against which we can say, oh, this is a good mathematical idea, and this is a bad mathematical idea, because it's all sort of made up.

And so there has to be choice that comes along of people saying, okay, this one is interesting. Let's put it in the curriculum and make everybody learn it right. So, what are those choices that get made? It's sort of similar to why are we putting the Mona Lisa in the museum. What is it about that that we all find so great that we think everybody should see it?

So, I think one of the ways in which these aspects of culture can be made more available to students would be to think about definitions. For example, if you're in a Grade 3 class and you're talking with students about how would you define a square? And different students can define it in different ways: four equal sides, they could talk about it being something that's symmetrical, if you turn it around by 90 degrees four times, lots of different ways. You could talk about the diagonals that intersect at 90 degrees and bisect each other. All of these different ways are ways of defining squares, and the students could discuss, well, which one is better? And maybe some will be more efficient, some will be more understandable, some will be more visual, which will appeal to certain people over others.

And all of this discussion, about what a definition of a square is, will bring out these different aesthetic aspects of which ones do we choose. Then they could go look at definitions of squares and textbooks around the world, and see, actually, people in Canada define squares differently and people in the U.S. and Australia and some countries have inclusive definitions of squares and some have exclusive definitions of squares.

So, it's not the same thing everywhere. And the reason why people choose one over the other depends on some of their preferences. Some people really like to have definitions that will include all of the shapes that are contained within the square because that makes it easier to prove things. You don't have to do it over and over again for each shape.

And some prefer to have a definition of a square that excludes other things that are not quite square. So, I think definitions are a fruitful place to help students see how much choice is involved and how much those choices are based on certain preferences, that we can see even a very simple idea of defining a square.

JT: I was interested particularly in that, because maths is done by humans and humans have their own sets of values and their own backgrounds and their own levels of wealth or education or, you know, they may be in the west or not. That how we do maths is also a cultural thing.

I was quite interested in how that might make maths feel more relevant to some students who were doing it, maybe more personal. Maths can feel very impersonal sometimes, the way it's taught can be very dry. And one of the threads running through your book really was the relational aspect of maths You were looking at an activity by Karl Bushnell, who was looking at maths problems in relation to climate.

AC: Yeah, Karl went through his teacher education at Bristol. I think it's really, really interesting, you know, he's continued to do bits of writing around how questions around the climate, for instance, might be relevant to look to the mathematics classroom. And with some really, really interesting things that he's doing. So, in one of the examples, he takes students through a set of problems where you end up working out how much would the sea level rise if the whole of the Greenland ice sheet melted. And it's really pretty straightforward. You need to know some key bits of information, but actually the mathematics involved is pretty straightforward. It's nothing more than arithmetic, really. One of the things Karl actually writes about, at what point do our responsibilities as math teachers stop?

I mean, it feels like when we come to conclusions that actually are beginning to have existential implications on Earth, that actually it's hard to contain that what we do in maths is just to do with numbers that actually we've got to start thinking about the implications of what this means and even just to allow space for the expression of anxiety perhaps or sort of horror or you know hopes. I mean I do think that we have a responsibility to also find places of hope for students and I think that all links in with the idea that maths is not culture free, that I think both of us would feel the mathematics doesn't stop at the point of getting the answer to the number of metres the sea level rises, that, elements of mathematics are also around what's that going to mean for different people around the world?

JT: I can imagine that, looking at maths in that way, really appealing to secondary and post-16 students. Particularly maths not being something that children or young people are going to need in the future. You know, I'm never going to do this again. When actually it's something that is incredibly important and, particularly, young people are so passionate about the climate and about what's going on in the world, I think it would probably surprise them to know how important maths is in tackling some of those problems.

Moving on to Dogma D, which is the maths myth that the NCETM is keen to dispel. Maths is for some people and not for others. And, in this chapter, we're thinking a little bit more about setting and differentiation and that sort of thing, and how those children can get, sometimes really young, that idea that they're not good at maths because of the way that adults have organised them in the classroom. I'm interested to know, and I think that teachers will be interested, and parents will be interested to know, how we might go about tackling that particular dogma.

AC: Okay. So, this dogma, that maths is for some people and not for others. I mean, I think we both felt this was a really significant one within the book for all the kind of social justice reasons that I think you're alluding to in the way you're talking about it. And again, yeah, I mean, I think for me, this is one of the really, really significant things that the NCETM has been trying to push. And I'm personally delighted to see that mixed-attainment teaching seems to be on the rise in England, I think, particularly at primary, but also, as far as I can tell, at secondary school as well.

I mean, it's interesting that one of the ideas that's sometimes used to help think about 'maths is for some people not for others', or one of the ideas that's used to combat this, is the idea of growth and fixed mindsets. And while we see some interesting things here, I think we both have a worry that the idea of mindsets brings us back to the idea that maths and doing well at school is all about individual characteristics. And one of the things I think is that it's not made clear in the idea of growth and fixed mindsets is really quite how you move from a fixed mindset to a growth mindset.

So, I think perhaps one of the things that's happened is that, whereas in the past I might've talked about: these students are in the bottom set or these students have got low maths ability, or then, more recently, hopefully, these students have got low maths attainment, low prior attainment. So now I might think, these students have all got fixed mindset. But it has this similar kind of feel really, that it's like the problem's in the students and I've got to find some way of getting them to shift. And, I think, we're really proposing in the book that if a child you're teaching has taught themselves a language, their first language, then really they

have all the skills they need to succeed at school-level mathematics way beyond primary school.

And so, if they're not succeeding, there is actually no deficit in themselves. That there cannot be because they taught themselves to speak. So, the issue is how they've come to relate to mathematics. So, I think what we're trying to suggest is that we encourage a framing that all learners who can speak a language are incredibly powerful learners, and if we recognise that achievement, then the thing is how can we build our learning in our classrooms on the basis of kind of respect for that incredible learning feat that they have achieved.

And I suppose it's that kind of idea that we're trying to move towards in the book and suggest some strategies for.

NS: Just to add on to what Alf was saying and to keep the idea of these being dogmas so that there's like they come from somewhere. I think in some ways in which we have historically taught mathematics, it has actually been only for some people. Right from the beginning, schools were for rich males in general, and then it took a long time for more and more kids to be welcome at school, but certain ways of keeping kids in lines and seated at their desks with their hands behind their back just doesn't work for a lot of people.

And so, it's not surprising if people say, oh, math is not for me or that I'm bad at math because what they're really saying is I'm bad at learning math, if that's how it's going to be presented to me, right?

It's kind of like going back to Alf's analogy of learning language. It's like, if you were just learning a language from one person who was giving you, you know, five words every day and that was it. And you had to master them before you got the next five words. You probably wouldn't think you would be very good at learning language too, but actually, you know, most kids are involved in a lot of complex, diverse experiences in which they pick up ways of speaking in different ways over time and aren't hit over the hands if they get the wrong word often.

So, I think one of the things we were really pointing to is the importance, for example, of bringing in visual ways of understanding mathematics or embodied ways of understanding mathematics, so that doesn't always have to be this one track, which is highly symbolic, let's say. Not that there's anything wrong with with symbols, but some people just have a much easier way of feeling comfortable with the mathematical ideas if they're given options into how they're experiencing them. So I just wanted to say that the dogma has some basis in real experiences that people have had.

JT: And it probably does come from that negative association. So, if you're not enjoying it, then it's not for me. And I think, that's fairly understandable, definitely.

So, our next dogma is that ‘maths is hard because it's abstract’. Which again, I thought was a really interesting chapter because it didn't quite go where I was expecting it to. And I found it really fascinating. I was thinking of concrete as being purely representational, but you

explored sort of different views of the concrete and the abstract. So, I'm interested to find out a little bit more about this dogma: ‘maths is hard because it is abstract’.

AC: Yeah, I mean, we do play around a bit in the chapter with what those words might mean, but I think I won't go into that now. If we just stay with perhaps a more typical meaning of the word abstract, there are elements of maths which do fit that, which do seem to be abstract. And if you read a page of symbols, you know, what on earth does it seem to be about? But I think one of the things we're keen to point to is that children actually have a lot of skills in abstract thinking. And, again, to come back to language, even if you think of a word like chair. That's a pretty arbitrary symbol for this collection of objects, all a little bit different other, but share some similarities. Well, really, what's that if that's not abstract? That it seems to be language is inherently abstract. So, whatever difficulties children might be having with mathematics, it can't be because they've got any deficits with abstract thinking, so that would be one reading of what we're trying to say in this chapter.

I mean, I think another thing that we want to suggest is that the idea that there has to be this movement from concrete to pictorial to abstract, where you try and get quickly to the abstract and then stay there. I don't think it’s very helpful. I think Singapore is one of the places where this model is used very extensively, and I think it would be fair to say that actually what happens in Singapore is, as quickly as possible, you get these three different ways of thinking, but actually you work on the links and connections between them, and all three of them stay around really for quite a long time. One of the things that I really love in the NCETM ideas is the idea of having a few representations that keep coming back through the curriculum from primary into secondary.

And so, one of those would be the number line. Now we might see that as a pictorial representation. I'm not sure. Why would you ever want to *not* use a number line? I mean, I still use a number line if I'm thinking about it. So, there isn't this sense that I've got to somehow go somewhere else before that.

If I choose representations that are powerful enough that they can stay with me throughout my mathematical career. At secondary level, again, the NCETM endorses trigonometry taught through a circle and a circle image. Again, that's a representation that you never need to let go of, in order to work with trigonometry.

And I suppose, maybe one other brief example. I think Gattegno, who you mentioned. In his curriculum, he suggests using number as length, thinking about numbers as lengths, which is a sort of way of making them concrete. And, again, it's actually a way of thinking about number that you never have to let go of.

It's an entirely consistent way of thinking about number right until higher levels of mathematics. And again, within the NCETM materials, I think one really fantastic innovation is that alongside introducing numbers as objects there is a strand through the professional development materials of dealing with number as length and so number as object, number as length run alongside.

And I think that there's a real power there in terms of offering students different ways into number and making links and connections across these two representations.

JT: So, numbers as length, you might be thinking of something like Cuisenaire® rods or bar model-type representations?

AC: Yeah.

JT: It blew my mind... I once solved a problem. It was a GCSE problem, and I was just playing around. It was on a podcast. And I solved it with a bar model. And then the hosts were talking about how they solved it. And one of them used a bar model and the other one used algebra. And I thought, bar model… is algebra?! How is that?

I had no idea that that's actually what you're doing when you're, when you're solving some of these, sort of, primary school problems with the bar model, it's actually algebra, which is just like… but there you go… complexity!

AC: I mean, in Gattegno's original curriculum he proposes you teach algebra before arithmetic, that you work on the sort of more abstract relationships between lengths and how lengths fit together. And only later do you then put numbers onto it.

JT: I remember when I was teaching in Year 6 and the children would know that they were going to be doing algebra and they'd say, when are we going to be doing algebra? Is it really hard? I can't wait to do algebra! And obviously they were terrified. I've just thought now that some of the problems we were already solving… I would have loved to have been able to turn around to them and say, you did it last year in Year 5, you know. That was algebra. Missed opportunity!

And that brings us to the end of part two. I hope our discussion of Alf and Nathalie's really fascinating and thought-provoking book has left you wanting to read it. I think anyone interested in how children learn or how we might go about teaching mathematics successfully will find it such a fascinating read.

Do come back and join us for the final third part of our conversation where we put your questions, shared with us on social media, to Alf and Nathalie. And, in the meantime, we'd love it if you could share this episode with colleagues, like the podcast and subscribe to our channel wherever you get your podcasts.

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