# The NCETM Maths Podcast Episode 77

## Maths games: part 1

Hello and welcome to the NCETM Maths Podcast. I'm Julia Thomson (JT) from the NCETM Communications Team and I recently visited the Centre for Mathematical Sciences in Cambridge, which houses Cambridge University's Faculty for Maths and is the home of NRICH, to take a deep dive into maths games with some real experts on the subject.

This is the first part of our conversation, which looks at some of the research into maths games, some common mistakes teachers may make when using them, and how to get them to really pull their weight in the classroom. I hope you enjoy it.

My guests today are Grace Coker (GC) from the EEF and Ems Lord (EL) and Liz Woodham (LW) from NRICH. I'd like to begin by just asking you to introduce yourselves to our listeners and to tell us a little bit more about who you are and what you do. So, if we could start with you, Grace.

**GC:** Hello, my name is Grace Coker and I'm the current Maths Content Specialist for the Education Endowment Foundation. So, I just started the role in January, so I've stepped out of the classroom for a bit after being a primary school teacher and leader for the last 15 years, based up in the Northeast. So, I'll just tell you a little bit about the EEF and what they do.

They're an independent charity and they're dedicated to breaking the link between household income and educational achievement. And they have three strands of work. So, number one, they summarise evidence of what works for teachers and school leaders. Number two, they build the evidence base by funding these high-quality evaluations of teaching and learning programs.

And number three, they support teachers and school leaders to use the evidence to inform their decision making. So, my role as a content specialist is to support teachers and school leaders to understand what the research evidence, for example, what a recommendation from a guidance report might actually look like in the classroom.

So, we create tools and resources and exemplification to try and make the EEF's work relevant, accessible and useful to school leaders and teachers.

**JT:** Lovely, fantastic. And Ems, if I can go to you next.

**EL:** Hi everyone, my name is Ems Lord, and I'm the current director of NRICH, which is a maths outreach project.

We like to think one of the biggest maths outreach projects in the world, and we're based in the Faculty of Maths at Cambridge, but we're a joint project between the Faculty of Education and the Faculty of Mathematics.

**JT:** Lovely. And Liz.

**LW:** Hello, my name is Liz Woodham, and I'm the Primary Coordinator of NRICH, which means I work alongside Ems, but I'm particularly responsible for everything primary, on the website and primary professional development. I've worked at NRICH for just over 20 years now, but before that I was a primary teacher in North London.

**JT:** Grace, you're exemplifying the EEF's guidance reports on improving maths and your particular focus is maths games. Can you tell me a little bit more about why you make math schemes your focus?

**GC:** Yes. So, I shall, first of all, start, by just saying a little bit about other workers that are content specialists. So, we have to try and create a campaign which involves highlighting and exemplifying maybe a recommendation from the guidance reports. So, when I started the role, I was thinking about what my campaign could be.

So, I did lots of reading of research and I reflected on my experience in the classroom. And so, research showed that children's attainment has negatively been affected by the pandemic, particularly those from disadvantaged backgrounds and our youngest children. But not only that, children's motivation and confidence have suffered.

And so, this is something that really struck me and something that I had experienced within the classroom with the children that I was teaching. Like post pandemic. So, it made me think about how important it is for us as teachers to deliberately create these meaningful mathematical learning opportunities.

So, Recommendation 2 of the Early Years Key Stage 1 Guidance Report highlights the importance of exploring maths through different contexts, such as storybooks, puzzles, songs, rhymes and games. And it was this games area that I really decided to focus in on. So why games? It was a context that I used a lot, pre pandemic when I was teaching year six, especially, to consolidate learning, provide that repeated practice, in a motivating context.

But something maybe that I've moved away from in recent years. So, it's an area that I'm personally interested in and wanted to learn more about and think about how they can be used really purposefully, and what the research actually said.

**JT:** Lovely. So, Liz and Ems, NRICH is the go-to place for mathematical games and rich problem-solving activities and resources.

I think most teachers will be familiar with what you provide. Ems, if I can start with you, can you tell me a little bit more about the background of NRICH and the aims of the project?

**EL:** Yes, of course, it's a fascinating background as well, because NRICH has been going now for 25 years, which I think is amazing for an online project, and I think it's an essential project even now, perhaps more so than when it started.

So, if we rewind 25 years and think about the world at that time. The internet was actually very new. Few people were going online, but there were some very exciting colleagues who were based at the Faculty of Education who could see the potential of online working for collaborating. And what they did, and this was a fantastic idea at the time, was take the idea of children sending in solutions by post, which would be very slow, changing that approach to sharing solutions online.

So having an online maths club 25 years ago. So, this was groundbreaking, and it proved really popular. But after a while people started realizing that it could increase its reach. Instead of reaching out to children, why not reach out to their teachers? So instead of reaching out to one child, you're reaching out to maybe classes of 30 children or whole schools.

So, the NRICH focus changed to work with teachers, and it still works nowadays with parents, with families as well. But that's how the project got started, and I don't think it's ever looked back. And with colleagues like Liz here, designing the resources, that enthusiasm and engagement just continues to grow.

**JT:** That is really impressive. I can't believe 25 years. I remember trying to go online 25 years ago and really the internet was in its infancy. I had no idea. That's amazing. NRICH resources are often recommended for use with higher attaining children in class. And that's recommended by teachers.

So, when a teacher has a pupil that's completing schoolwork in class much more quickly than their peers: what can I do with this child? Teachers will say give them a problem from NRICH. But Liz, as primary coordinator for NRICH, how would you like to see teachers using NRICH resources?

**LW:** Thanks, Julia. Yes, I think, many of NRICH resources are what we at NRICH call low threshold, high ceiling. So, the phrase that we've come up with is really: everybody can get started, but everybody can get stuck. So, actually, many of the activities and games on the NRICH website are suitable for whole classes.

So, we would love to see teachers introducing a whole class to an NRICH game or an NRICH problem, getting children started, giving them time to explore, perhaps in pairs or small groups, and then the teacher's role is giving the children opportunity to share their thoughts and ideas with each other, so that as a whole kind of mathematical community in your classroom, you can then work on the mathematics of the game or the problem all together. It's very much an inclusive approach, not just for high attainers.

**JT:** So, maybe moving on from that, we talked about what you would like to see, what misconceptions do you think teachers might have about using games in the classroom?

**LW:** I think possibly that it's tempting to think of a game as, you know, a quick filler type activity. So maybe, you know, occupying a spare moment or given, as you alluded to earlier, Julia, perhaps just to a few children if they've finished what they were asked to do originally. We would really like games to be seen as much more than that. Many games have so much potential, and we would suggest that they can be carefully planned and integrated into the structure of mathematics lessons across the school.

We'd encourage teachers to really make the most of the mathematics and see the potential of games. And I guess I would suggest that one way to do that on NRICH is to take a look at the teacher's resources which accompany the games to give you some ideas about, why they're worthwhile and, what you could do with them in the classroom.

**JT:** What about you, Ems? Have you got anything to add to that question? What misconceptions might teachers have when they're using games in the classroom?

**EL:** I think that's such a good question, and just to build on what Liz was saying there about looking at the teacher's notes. Quite often in the teacher's notes, there's a line or two about the settings.

So, when we have a game, maybe an interactive game, instead of just playing it once, what you can do is then you can alter the settings. So, it could be the range of numbers, or the operation. And what's really great, if you can get the children to prompt it. So, having played the game, what would you like to change?

Is there something you'd like to do different? And then as a teacher, you can go to the settings, adjust it along those lines, and then let them continue exploring. So, the children are making a really important move there from being problem solvers to problem posers.

**JT:** And it seems to me that brings in that variation that we want to see in our maths lessons but it's actually putting it a little bit more in the children's hands. So what variations would you like to make? What do you think Grace?

**GC:** I definitely agree with what Liz and Ems say and I think when people think about games they think fun. They just think it's like a fun filler activity, but actually, you know, games are naturally engaging. They're naturally motivating, but they are so much more than that and they have such potential.

It's really important for teachers to think and carefully plan. The reason, the purpose, that they're using in the game. So, you know, why are we asking the children to play this game? Is it to reinforce a new mathematical vocabulary? Is it that opportunity for rich mathematical discussions? Is it to generate that repeated practice?

Is it actually: we're going to give them this game to find out what children already know, and that will, better inform future lesson planning. So, it's, you know, there's so many purposes behind it.

**JT:** That's interesting, that put me in mind of the NCETM *Checkpoints*, which are very much assessment tools. So, what do the children know, what do they understand, and how can we explore their understanding, which is so important in a maths lesson.

So, another question. Those of us who work in the field of maths education know that we love our research. We do very little without some kind of evidence base. Grace, what can you tell us about the evidence in relation to games and when and how they should be used?

**GC:** Absolutely. So, my campaign is called Purposeful Playful Practice. Obviously, I love a little bit of alliteration there! And the whole point of the campaign is focusing on what the evidence tells us about the potential benefits of using mathematical games and highlighting how they can be that purposeful teaching and learning tool.

So, I have read the relevant guidance reports from the Education Endowment Foundation and I've kind of created this summary of, how they can be used purposely. So, for example, they can be that example to generate repeated practice or extend skills. They can support learning at home through those parental practical ideas.

They can help find out what children already know. They can provide opportunities for retrieval practice, develop number sense, reinforce mathematical vocabulary, or provide opportunities for those rich mathematical discussions. So, within my campaign, I've written various blogs and asked guests to write blogs as well.

And we try to exemplify a particular game and showcase the evidence informed purpose of them. So, for example, in one of my blogs, we highlighted an NRICH game called Strike It Out and how it can be that great way to reinforce mathematical vocabulary, the vocabulary of sum and difference, as well as generating that repeated practice of addition and subtraction of numbers to 20. But it's all got to be super carefully planned.

**JT:** Ems, what is the research base for NRICH and what have you learned as the project has developed?

**EL:** I think when we're talking about the research side, it's really important that it goes together with the resource development. So, we tend to do an iterative approach.

So, Liz may be working on developing a new activity or have an idea for it. We'll go back, we'll look at the existing research and that might be sufficient to inform what it is we've got in mind. Or it could be a case that we say, do you know what, there's nothing out there at the moment. And then we'll start to plan some research and collect the data to help us do that.

But whenever we do that, what's really important is that we're working with schools, trying out ideas in the classroom and using those findings to help develop the resources and the guidance that goes with them that Liz was talking about earlier. So, a really nice example was we were looking at going deeper. Working with pupils who are looking at mathematics at greater depth. And we went into some schools who very kindly explored some NRICH resources, inviting me to go along and see what was happening. And the messages that we

got from the schools there helped inform the guidance that we then included in our Going Deeper project.

And Liz then put in some of the activities there to complement the research. So, I think the two things go together, the resource development and the research. Sometimes one drives the other, but I think they both need to be there. We need to be confident that what we're doing is helping students become better mathematicians.

**JT:** Grace. Another of your blogs discusses embodied learning. What is the science behind this, and how can teachers harness it in their classroom?

**GC:** Yeah, so the blog that you're referring to is called Let's Get Physical. So, Embodied Learning refers to strategies that engage and make use of movement and the body to support effective learning. Naturally, I think as teachers we naturally make these gestures and have this physical movement. So, it's thought that by designing tasks and activity that appeal to young pupils in a multisensory way, teachers may be able to make new information more easily comprehensible and memorable.

However, the evidence around embodied learning is limited, but the studies that we do have available do show promise that these approaches that involve that physical enactment can improve pupil learning in mathematics. For example, children physically moving along a large number line, or clapping while counting. Probably all schools have that large number square in their playground. Creating games where the children might physically jump in multiples can possibly help the children to see patterns. So, it's quite an interesting area that probably as teachers, a lot of us actually, naturally do. It's definitely an interesting area to look into.

**JT:** It reminds me of, Debbie Morgan recently on a podcast was talking about finding the midpoint. And it was very much, getting a piece of paper, folding it in half, getting a piece of rope, the child putting a teddy on it in the playground, and getting outside, drawing chalk lines, and that sort of thing.

So, moving on to mathematical talk which obviously games and problem-solving activities will give us lots of opportunity for that. It's recognised in research as an important way to develop metacognition and deepen understanding. So, Grace, how can we use games to practice mathematical talk?

**GC:** Yeah, as you say, Julia, that there's that wealth of evidence which indicates that talk can play an important role in supporting that mathematical learning. And, actually, well designed games, mathematical games, can be valuable for stimulating the rich mathematical discussion. The context of a game can actually be that instant hook. Children might be motivated to justify and prove their answer because actually it's a competitive thing. They want to prove that they're right because winning is at stake. When playing a game, children might discuss strategies. They'll be able to deepen their mathematical understanding.

They might be able to apply what they've learned in that brand new context of the game. I also agree with what Liz said earlier about games being that inclusive environment where all

children can take part in mathematical talk. So, you know, going back to the work NRICH does, I know that I used as a teacher; they have these great videos, these silent videos of a game being played, and already just the children watching that, that's that opportunity for mathematical discussion because asking questions like: Ooh, what do you think the rules of the game are? How do you think you might win? That gets the children talking already and using mathematical vocabulary.

And then once the children have played, maybe competitively against each other, posing reflection questions after the game can often inspire that meaningful mathematical reasoning. That children actually then work on together, rather than, working against each other, they then work together. So, there's just that wealth of ways that games can support mathematical talk.

**JT:** Well, that's the end of part one. You were listening to Grace Coker from the EEF and Liz Woodham and Ems Lord from NRICH. If you'd like to find out more about how maths games can be used to encourage collaborative problem solving, engage with parents and families, make homework fun and even addictive, and learn what our experts' top tips are for using games in the classroom, including some recommendations of games that you can use, then make sure you come back to listen to part two.

In the meantime, if you enjoyed listening, please do share this podcast with colleagues, like the podcast and subscribe, wherever you get your podcasts, to make sure you never miss an episode.