

# The NCETM Maths Podcast Episode 77

## Maths games: part 2

Hello and welcome to the NCETM Maths Podcast. I'm Julia Thomson (JT) from the NCETM Communications Team and this is part two of our conversation on maths games with Ems Lord (EL), Director of NRICH, Liz Woodham (LW), NRICH's Primary Coordinator and Grace Coker (GC), Maths Content Specialist at the EEF. [Part one](#) saw us looking at some of the research into maths games, some common mistakes teachers may make when using them and how to use them to encourage mathematical talk. If you missed it, I would encourage you to listen to part one of our conversation first. Still with us? Then listen on as we explore how we can use games for collaborative problem solving, encourage parental engagement and put the fun into homework and our guests will be giving us their main takeaways for using games effectively in the classroom. We're going to dive straight back in now.

**JT:** So, Liz and Ems, collaboration and group worthy tasks are a key focus for NRICH. I'll go to you next, Ems. Why is collaboration so important and what impact can it have on children's mathematical development?

**EL:** Well, I think to answer your question there, Julia, it's really worthwhile just taking a moment to think about where we're sat at the moment, because the group of us are gathered together at the Faculty of Mathematics at the University of Cambridge.

So, as you said earlier, that's where NRICH is based. And if we go out of this door into the main hallway area, there are groups of mathematicians of all ages, undergraduates, postgraduates, researchers. But the key thing is... They're sat together. They're working on problems as a group, because it's so much better to hear other people's ideas, be inspired by what they're working on, learn new strategies, and work out the most efficient ways of working. And you can only do that when you collaborate.

Now, at NRICH, we specialise in enriching the maths for all learners, so we look at it as a journey from early years through primary, secondary, and those post 16s who are considering studying mathematics at university, and what skills they need. And it's really clear they need to be able to collaborate.

But that's one strand, there'll be some who go off to study at university. I mean, let's be honest, most aren't going to. They may go to uni, but study something else, or they may go straight into work. But we know whatever they end up doing, they're going to have to work well with other people, understand how to take turns, and the importance of learning from one another.

And so at NRICH, we build that in right from the very beginning when we're planning resources. We have certain key skills and key attributes we'd really like young people to develop. And one of those is the ability to collaborate. So in all the work that Liz does and the other colleagues at NRICH that we work with, collaboration is absolutely key.

**JT:** Absolutely, and it strikes me that if a teacher is thinking, well, doing this collaborative task is going to take a large chunk of my lesson time, actually seeing that collaboration as a vital life skill gives more of a permission to take that time to work on that group task.

So, we're now going to look at some examples of games and how they can be played. Liz and Ems, what game or games would you like to share with our listeners and how can they be used by teachers?

**LW:** Well, we'd like to tell you a little bit about a couple of versions of NIM that we have on the NRICH website. One, which is most accessible, is called NIM-7, where you have seven counters. And you take it in turns with a partner to take one counter. Or two counters. And the winner is the person who takes the last counter.

The other version we have on NRICH is called Got It. And this is a number game. [00:04:00] And again, you take it in turns with a partner, or you can play against a computer. And you're choosing the numbers 1, 2, 3, or 4. And then your partner does the same. And your partner's number is added on to your number, so you're making a cumulative total. And the winner is the person who hits the target of 23 exactly.

So, you can see that there are some similarities between these two versions of the game. The reason we've chosen these particular games to tell you about is that they're really accessible. Everybody can start playing either of these games. The context is really non-threatening and very low threshold. Now, of course, as you're playing, let's think about the Got It game. You can play on NRICH against the computer, and we've got some purposeful practice of number bonds. You may also be drawing on your knowledge of factors and multiples.

The higher order thinking here, and the extra challenge comes with developing a strategy: can I always win this game? How do I always win the game? And then, Ems talked earlier about our little purple cog on some of our settings. If you click on the purple cog, for Got It, you can tweak the game. So, how do I play differently if my target number is not 23? How do I play differently if, instead of 1, 2, 3 and 4, I've got a 5 as well? And what we're doing is we're offering an environment in which children can draw on their number and calculation skills, but they can conjecture, they can explain, they can justify, and they can even prove how they know they're going to be able to win the game, no matter what the settings.

**JT:** Excellent. And I had lots of fun playing Got It.

**LW:** Good!

**JT:** I didn't realise that you could change the settings. So, I'll go home and have a play about with it and see what I come up with. What about you, Grace?

**GC:** Yeah, there's just loads of ideas and there's loads of fantastic free ideas on the NRICH website.

When I work with teachers, they are super creative, super creative, and they easily adapt these activities, these games, so that they're right for their context, and what they want their children to learn, and they might edit certain games and pop in sort of sentence frames depending on what the purpose of the game is.

But something that I've been introduced to recently is a game called Number Hive. It's free, there's a paper version and an app version, so if you just google Number Hive. There are different game boards, but one is about generating that repeated practice of multiplication skills. So, you know,  $7 \times 5$ ,  $4 \times 3$ , etc.

But really, at the heart of it, it's a strategy game. So it can be that way to promote mathematical talk. Getting the children to vocalise their reasoning for the choices they make. And it's a really sort of fun, addictive game that I've spent you know, time playing. Because it's that strategy game where you often have to think sort of two steps ahead and then getting the children to vocalise why they made that move then. The children sort of thinking about well they don't want to help their opponent in a few further steps time.

So I definitely recommend that game. But there's loads of books out there as well. There's this lovely book called Making Maths Visual and Tactile that I really like. It's written by Judy Hornigold. What I like about it is lots of the equipment are just things that teachers would already have in the classroom: counters, tens frames, playing cards... so I think that's a really important thing for teachers to think about because we are time poor. So, you know, we don't want teachers spending lots of time creating resources, cutting up resources that are only going to be used once. Use the equipment that's in your classroom already.

**JT:** Absolutely. So, Grace, encouraging parental involvement in children's maths practice is something schools are always trying to develop. How can games be used to encourage this?

**GC:** There's that idea that parents' interest and involvement in their children's learning is consistently associated with positive outcomes for children of all age groups, but it can be really challenging for schools to influence this effectively.

Recommendation two of the EEF's guidance, working with parents suggests providing those practical strategies to support learning at home, especially for younger children. So, home learning activities like playing with numbers are linked to improved outcomes. So, working with parents and giving them practical ideas in a game solution, in a game way can be a non-threatening way.

I've recently been speaking to a school in North Tyneside called Greenfields Community Primary School, and they have been telling me about what they do to encourage that parental engagement. Every half term, they invite parents or carers from their preschool, nursery and reception into school.

And they set up activities in their learning environment, both indoors and outdoors, the children and adults can enjoy doing together. And so mathematical learning activities might include playing games, singing songs, sharing a storybook, completing a puzzle and the school staff are there and they model that activity, and they model the interactions and the

language, and the staff explain the importance of reinforcing the vocabulary and give these ideas of how they can do a similar activity at home with no specific equipment needed.

It's a great chance for parents, carers to see how maths can be integrated throughout the day. For example, counting characters in a storybook, spotting, recognising numbers on a door, etc. These sessions are regular, they're planned, get parents in and get them involved and there's lots of continuation.

The parents are often uploading photographs of games they've played at home, and it is that motivating context and it's that non-threatening way to get parents involved.

**JT:** Lovely. How about you, Ems? I understand that NRICH have a parental project that they're working on. Can you tell us a bit more about that?

**EL:** Yes, I'd love to because it's such an exciting project and I think it complements some of the things that Grace has just been talking about there, about working with parents. So, one of the things that we were looking at was how to increase parental engagement. And as soon as we started thinking about it, we realised there's so many different definitions of what we mean by parental engagement.

So, if you're going to try to increase it, you have to take a step back and think, well, what is it we're actually looking for? And when we did some research into it and took some soundings, there were people who were saying, well, parental engagement is about making a space to do the homework. Or in another home, it could be, well, parental engagement is making sure that you check the homework diary.

Another person might say, no, for me, parental engagement is, I've checked they've done the homework and that it's correct. And then you have another group who say, no, my parental engagement is sitting down and working with them. So that was the first challenge. What sort of parental engagement were we looking for?

And we really focused on that latter one, about sitting down and doing the maths together. But as soon as you've decided to do that, you come across a whole new load of barriers. Because it's not just the children who may need encouraging and engaging. It can also be the adults. And they may bring a lot of baggage with them from their own experiences.

So, the challenge is, how do you get parents engaged when they may be reluctant mathematicians themselves? So, we spent a lot of time looking at this. We looked at the research. We talked with colleagues about what works well. And the messages that we got were very clear. Don't try to ask parents to teach something at home.

There's very limited family time sometimes, when children come in from school, they could be tired, they might have clubs, and then you're asking parents to do teaching. And the parents may turn around quite rightly and say, 'Well, how do I know I'm teaching it the right way? I don't want to be saying the wrong things. I don't want to contradict the teachers.'

So, we took a different approach. We said, well, why not take that step back and choose activities which reinforce things the children already know but choose games that are fun to play. So, you can have adult and child playing together. And to support the parents, we recorded some very short videos with colleagues at NRICH, modelling the game and just explaining where the maths is.

Because if you're a non-specialist, you could be playing a game and not actually appreciate where the maths is, especially if it's not a number game, but a different area of the curriculum. So that's exactly what we did. We identified a selection of resources, and we recorded the videos. And we recruited some schools.

As always, the schools were fantastic. They invited us in at the beginning of the project. They set these activities on a weekly basis. And we went back in at the end. And we had such a lovely way of evaluating it. We did the normal questionnaires and teacher interviews. We did all that. But the other thing we got to do, which was incredibly exciting and really insightful, we asked the children to draw pictures of themselves doing their homework before the project and after the project.

And we learned so much just going through those diagrams, because in some of the families we found children were often doing their homework by themselves, not talking, not communicating their mathematics. And because we could compare before and after, when we compared the later pictures that they drew, quite often, we found that they changed rooms.

Maybe they were sat in the kitchen, the dining room, the lounge, but there were other people there. And in some cases, they'd invited their friends over, and they were playing the games together. So, the maths moved from being something that was individual to something that was collaborative and there was one child I spoke to, and I'll never forget this because I asked about their experiences with the games and they said 'Well, miss, it's like fishing'. That totally threw me.

How did they get there? So, I did the normal teacher thing of saying, 'OK, can you explain that little bit more to me?' So, they very patiently sat down and explained why maths is like fishing. And they said, 'Well, the games are like hooks. When you fish, you have the hook in the water'. And they say, 'The games hooked me because when I was playing them, I didn't just want to win, I wanted to understand how to win'.

And this was the really exciting bit, because they then explained, they had an older brother, who beats them at everything. But because they knew this game, and crucially they understood the mathematics behind it, they could go away and challenge their brother, and for once, they could beat them. Because they said they were younger, and the older brother always knew everything, but not in this case through the games.

And then they explained that they then went away and played the game with parents and neighbours. So, this was a really interesting finding. So, we then went back and looked at the data, so the number of times the games had been accessed online. And they were being

sent weekly, so you'd expect week one, a particular game, to have a peak, and then in week two, the next game to have a peak.

But what we found from the data is the game introduced in week one continued to be played throughout the half term. They kept coming back to it. And the bit I particularly loved was the number of families who were playing it over Christmas. I just thought YES! We've really hooked them there. Christmas Day! And they're playing maths games.

**JT:** So that project was called, Solving Together, isn't it? It's on your website. I have a son in Year 8, and I would love his homework to be more like this.

As teachers, we're always thinking about homework, how can we make it useful, we're setting it, sometimes for the sake of it, and the children are doing it independently, so often parents will lament: I don't know how to help them do this homework. It was really stressful. We were arguing over it, and this just seems to be a really fantastic way of doing homework, having a whole family involved, making it fun, but more importantly for parents, particularly parents who, as you say, might have negative associations with maths, making it really accessible and not intimidating.

Finally, I have a question from one of our followers on social media. She said she recognises that most maths games provide opportunities to practice known procedures and reinforce existing knowledge. What games, or kinds of games, provide opportunities for new learning? Liz?

**LW:** I think that the user you referred to said, to reinforce existing knowledge. I would argue actually a little bit more strongly than that, that a mathematical game has the potential to really deepen mathematical understanding.

It's not just about, sort of, reinforcing. It's because you are offering an activity in a particular context and learners are having those opportunities to explore, to experiment, to conjecture; it really allows you to make new connections which deepen your understanding, not just as a surface level reinforcing, if you see what I mean.

**JT:** Brilliant, that's a good answer. Well, that brings us almost to the end of our conversation today. So, I'd like to end by asking you to share your top tips for using games in the classroom. So, it could be something that we've mentioned that you just think is really important for teachers to think about. We'll start with you, Grace.

**GC:** Thank you, Julia. I would just say really think carefully about what the purpose is and think about when you're choosing a game, does it need to be edited to maximise the potential learning opportunities? Think about when in the sequence of learning is it going to be useful?

And also, what is the role of the adult going to be when the children are playing the game? Are they going to be models? Are they going to listen in and make prompts? Are they going



to pose extra questions? So, I think that's really important. What is the adult going to do while the children are playing the game?

**JT:** Not doing marking or planning something else. Liz?

**LW:** Yeah, to add to what Grace said, I think I would encourage those of you who are teachers, to play the game yourself first. So that you can really make the most of the mathematical opportunities.

**JT:** Brilliant. And that might sound time consuming, but I think it is really important when we're planning to think about what is going to be useful rather than, getting things down on paper. It's actually immersing yourself in that task and thinking about how you're going to teach it. What about you, Ems?

**EL:** Well, I think Liz makes such a great point there about investing the time in playing the game ourselves before we try them out with our classes and when we're doing that, what I would really recommend is something that we talked about earlier. That purple cog on the interactive games. By all means, click on that and explore the potential of the different levels. It's well worth the time doing it. It can be slightly addictive because you will play with it. However, having that knowledge and that understanding of the potential of the game will be rewarded back in the classroom.

**JT:** Well, that's the end of part two and it brings our conversation on maths games to a close. Thanks again to Grace Coker, Maths Content Specialist at the EEF, Ems Lord, Director of NRICH, and Liz Woodham, Primary Coordinator for NRICH for speaking to me about maths games. We hope you enjoyed it. Don't forget to take a look at our show notes for links to the games, research and resources mentioned by our guests.

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