KAREN FOLEY: Welcome back to The Student Hub Life STEM Showcase. Well, now we're going to talk about the new maths and its learning curriculum. I'm joined by Rebecca Rosenberg, who is a lecturer in maths education, and also Cathy Smith, who is the qualifications lead for the degree maths and it's learning. So welcome today.

I know lots of you at home are interested in this particular session. We've made it very interactive. Let me just remind you about some of these word clouds that you will see on your screen. We've been asking you about three of the things that your best teachers did at school to inspire you. Now, these word clouds, as I've mentioned before for those of you who were here at the start of the show, need three things. But if you can only think of one or two, that's absolutely fine.

You do, though, need to put a full stop in the box. Otherwise, your results won't submit. So tell us what some of the things are that your best teachers did at school to inspire you and-- no names because of data protection-- but some of the worst things that you remember about a teacher. So fill those in in the boxes.

So welcome, Rebecca and Cathy. I began our careers section by asking our experts from the Careers and Employability Services about whether they were in fact in their dream job, and a lot of them said no. So I'm going to put the same question to you. Cathy, did you always want to be a maths teacher?

CATHY SMITH: Oh. Well, it's my dream job now, but when I was a teenager, I wasn't always that good at maths. And I really wanted to be-- I wanted to be a lighting designer. I loved theatre. I wanted to point the lights, get the angles, get the shadows. That was where I really saw myself. And why this matters to me now is because I went on a course to find out about-- at a theatre to find out about being a lighting designer. And it was me and four boys.

And somebody said to me, you can't be a lighting designer because we haven't got any ladies toilets. And that has just stuck with me because that is not how I want girls today to be feeling about maths and science. I want them to feel that maths and science and anything like that is for them. And so that was one of my passions about my research, is that you can do it, and everybody is at home in maths and science. And that's why so that's something for me about good maths teaching.

KAREN FOLEY: Brilliant. Excellent. Gosh, also I also used to want to do lighting design as well, but not for the same reason. But isn't it amazing how times have just changed so dramatically? I don't think you'd get that now. But probably lucky for us, Cathy, that they didn't have those toilets in operation at the time or you wouldn't be here today. What about you, Rebecca? What did you want to do?

REBECCA ROSENBERG: Well, when I was really little, I wanted to be a clown, which I don't know if that's a sensible career choice, and that stopped quite soon after I decided. But I remember getting really interested in maths when I was doing my GCSE's, actually. I'd always kind of liked it and been good at calculating and things, but I never thought that it was amazing.

And then I just had this really nice teacher who explained things in a different way, in a clever way. And I really liked-- I remember the topic that we were doing. It was about sectors of circles. And I just really liked the way that you multiply it by the proportion of the angle of a full circle, and that gives you the area of the sector. And it all just fit and it all worked together and seemed to really nice and closed. And I really liked that about maths, and then that's when I started thinking, well, maybe I could do maths beyond GCSE and do A level and maybe a degree and maybe-- who knows? So yeah, it's just all worked out like that.

KAREN FOLEY: Brilliant. Excellent. And interesting, I guess, how we end up in those different places. By listening to our guts and things that excite and inspire us, we're able to perhaps go in different directions. Well, we asked everyone at home about some of the things teachers did to inspire, and that's really at the heart of today's session.

Because I remember when I was younger at school, and physics in fact, trying to avoid all of the circuits that I couldn't quite managed to do, et cetera. And my physics teacher said to me, Karen, anybody can learn anything. It just depends how quickly and in what way. And that's always really inspired me, because I've thought sometimes if I didn't understand something by reading, I might just need to look at things differently. And for me, that's always a sign of a best teacher.

But let's see what some of the things you've said about things that teachers did to inspire you. So here we go. Some of them are using real life, which is the key thing. People who really love their subject. Using praise. Interesting topics. Trying different ways of doing things. Making things fun. Having conservation areas-- or sorry, conversation areas. Using positive feedback.

Not giving up. Giving extra information. Being approachable. Enthusiasm. And being knowledgeable. Being strict-- that's quite an interesting one, actually, as well. I know when I've been teaching, sometimes I think somebody might want, for example, something but maybe not in the best interest for that student. And sometimes it's hard to say, actually, let's just do it now and get it over and done with.

So tell us then, Cathy-- one of the modules is called mathematical thinking in schools. What's the difference then between mathematics and mathematical thinking?

CATHY SMITH: So we could think of mathematics as being what mathematicians and scientists do and they publish in books and they write about at university. But mathematical thinking is what we all of us have the capacity to do to make sense of real life. And even as young children, we sometimes say, put on your mathematical glasses and see the world through numbers, counting, measuring, ordering things.

And when you work with young children, sometimes there's the curiosity about learning the pattern of counting. It's almost poetic. So that kind of mathematical thinking, that's something all of us can do. And as teachers, that's what we're really interested in, is thinking about all the different ways that people can think mathematically, not just how I get to the end of the problem, but how other people think about maths as well.

So teaching is really people focused. It's about how people think, not about what's written on the page. So in our modules we have, we talk about mathematical content. So that's things like do you understand place value? Do you understand angles? But we talk about mathematical processes. So calculating is a process, but defining, explaining, classifying, all these things that help you think mathematically and help you think critically and are in all of maths all over the world, not just in particular topic areas.

And then, I suppose another thing about mathematical thinking [AUDIO OUT] maybe by the time they've got to us, they've automated their mathematical thinking. They just know they're on a single track to the right answer. They know what to do. But you've got to work it back and think about the steps and where people might go differently and how to make those steps explicit again for other people. Because novices don't think like experts. Children don't think like adults. So you've got to get in touch with the ways that you learned to do things and not the way you just see how to do it now.

KAREN FOLEY: It's interesting. I've been homeschooling like many people have, and the maths has been quite challenging because the way I was taught maths when I was little is very different to the way that it's taught now in schools. And one of the things I've noticed was this notion about getting the right answer in the right way. And very often, my daughter and I would use different workings to get there. Is something around mathematical thinking that flexibility, Cathy?

CATHY SMITH: Yes, I think the-- there is an efficient-- often, the final way we end up-- there is an efficient way to do it, but too often people can't start a mathematical problem. So having flexibility is like, well, can you think of a way to start? And if-- what somebody said about make it fun. Make it something you can do. We start counting. We have a go. We get some confidence.

And once we've got a few flexible ways of doing it, draw a diagram. Say something out loud. Those things just get you started, and then you can work towards the most efficient method afterwards. Because efficient and effective is great, but flexibility to help people get started to get over that barrier.

KAREN FOLEY: Jenna says, it's so sad that so many people say that they can't do maths. And I've heard this so often before, particularly when people aren't doing a pure mathematics qualification, but perhaps maths is implicated somewhere along the way that that's not their core area. And there can be these massive fears and anxieties that perhaps are stemmed from our school days.

Let's take a look and see what some of the worst things that teachers did are, because people have been filling them at home. And one of the key things here is making me feel stupid. I think this is one of the key things that can put people off. Or when they were bored or shouting or being disengaged. So a lot of these, I think, reminiscent of the way that people had taught in the past. Or being sexist there. No experiments. Being unapproachable. Being unprepared.

Oh, chalk and talk et cetera No praise. So there's something here about teaching that's more than just the process for people, and I think that's absolutely right. Rebecca, Cathy mentioned before that sometimes people do mathematical thinking. We do this in everyday life, I think, was the point you were making earlier. How might that relate to this topic now?

REBECCA ROSENBERG: Well, sometimes people engage in mathematical thinking and they don't even realise that they're doing it. And one of the things that our modules try to do is help people become aware of when they're thinking mathematically. So mathematical thinking in schools, which is ME620, that's got lots of activities in that-- it's not just, answer this maths question, or even, how would you teach this to a child or a learner?

It's actually looking at how you've approached a problem or a question and what processes you've gone through, how you've been thinking about it, instead of just getting the final answer. Because it's really important to understand your own mathematical thinking if you want to help learners realise the way that they're thinking mathematically as well and help them to communicate what they've actually done. We've actually got a question--

KAREN FOLEY: Can you give us an example then?

REBECCA ROSENBERG: Yeah. Yeah, we've got an example. So I love--

KAREN FOLEY: Good.

REBECCA ROSENBERG: --and excuse to play with LEGO, so I've taken my son's LEGO and I've made this sequence, which is one of the ones that appears in ME620. So anyone who's studying that might already be familiar with this. So we've got a sequence of patterns. And you might say, OK, well, I know what the fourth one is going to look like. But a more interesting question to ask to explore how you think mathematically is to ask how the sequence is growing. How would you generate the next one? Not just what is it, but how does the sequence increase?

KAREN FOLEY: So we've got a widget that we'd like you to fill in. It's a multi-choice one. No one knows what response you've put. But have a go. Imagine the pattern growing. What do you see first? Is it the central square, the large square, the four corners, or the border? So if you fill that in, then we can take from that. Sorry, Rebecca, just wanted to give people that prompt to do that.

REBECCA ROSENBERG: Thanks. So if you've answered the question, you might have thought about the central square getting bigger each time. Or maybe you looked at the four corners and noticed those expanding. Or you might have looked at the border or the whole square. Everyone notices different things. And that's the point that we were getting at earlier about there's not just a right or wrong way. There's lots of different ways of approaching mathematical thinking. And it's the role of the teacher to recognise that and help learners understand that there's no right way.

KAREN FOLEY: And as we saw before with some of the things that teachers were doing that was really helpful and unhelpful, it was saying something was wrong or shouting at people or making people feel bad about things. It's about encouraging and understanding, I think, that's so much more fundamental in terms of those responses.

So let's see what everyone at home said in terms of this question. So here you go. This is our results. We've got the majority of people saying that-- 36% say it would be the border. So can you give us some feedback, Rebecca?

REBECCA ROSENBERG: Well, Yeah. That's different to me. So if I was teaching you and I didn't realise that everyone thought differently about things, I'd have said, oh, well, this sequence increases because the middle square gets bigger by one in each direction each time, and that's how it increases, because that's how I see it. But that's not the only way. As we can see, everyone said different things.

KAREN FOLEY: Yeah, absolutely. And both the right, aren't they?

REBECCA ROSENBERG: Yeah. All options are right. And the problem can even be extended. So if you were to say, oh, what would-- if there was another pattern before this one-- so this is the first pattern that we've got, but if there was one over here before that one, what would that look like? So work backwards. And that's even less well defined, really, because it could be anything.

I've got some examples. So maybe, if you've been thinking about what that other sequence would look like before that one, it could just be a central dot its own with no border, if you work backwards. Or it could be just the border. Or it could just be nothing at all, there's no sequence, because it all depends on how you decide to generate that sequence [INAUDIBLE] That impacts what it before. And there is the right answer.

KAREN FOLEY: So what do you think, Rebecca, the most important thing is for people to understand about learning maths?

REBECCA ROSENBERG: Well, I think it's just that, actually. If someone wants to help someone learn maths, alienating them or making them feel like it's not for them is-- well, it's not going to help. The point about maths being right or wrong, for me, that was-- I loved it. I love the fact that everything was there in its place, and it makes people feel safe that there's this set way of seeing maths. A lot of people really like that about maths.

But for some people, they just don't. They want the chance to explore and change things and scribble things out. And maths can be like that as well, as long as we find the right activities.

KAREN FOLEY: So very often, maybe our conception of seeing maths as having a right or wrong answer isn't quite clear cut. You've got another question for us that we'd like people to fill at home. So we'd like to know that the name of this shape is. Rebecca has a shape for us. Remember, with our word clouds, you can only put one, two, or three things. And put a full stop in if you only want to say one name. Or you can say multiple names as well.

So let us know what you think the name of this shape is, and put one or two things in the box and a full stop. And we'll just wait for those results right now, because I bet there'll be a whole range of different answers coming through for that, Rebecca.

REBECCA ROSENBERG: Maybe, yeah, although people were quite in agreement on the other question, so we'll see what comes up.

KAREN FOLEY: Brilliant. While we wait for that, Nicola, how's everyone doing back at home?

NICOLA: Everyone is doing well. We've got quite a comment from Colin about the last question that was posed on the LEGO. And the comment was that there's an irregular space in between square 1-2 and square 2-3. Don't know if you want to comment on that.

REBECCA ROSENBERG: That's a really good point, actually. When I was playing with this LEGO, I didn't think about the spaces between the shapes. I also didn't think about the colour. A lot of people might have thought that the sequence generation was to do with the colour because there was green, yellow. But I just used the LEGO that my child's got. And yes, absolutely, sometimes with all kinds of learning, things happen and there's distractors that might appear to be important to some people that actually, they're not something that the person asking the question has thought about. And that can happen a lot. So it's important to be aware of that. Thank you for raising that point.

KAREN FOLEY: Brilliant. Absolutely. So let's-- sorry, Nicola. Did you have something else?

NICOLA: Yeah. It's just going back to some other comments in the chat box so we were talking earlier about the fact that maths is taught differently now and it could be a challenge as an adult to help your-- if you've got children or young people around you, to support them with their maths. And Vanessa had commented that, actually, she learned maths in a different country, and her child-- her daughter is now learning in the UK. And she's finding that really challenging because it's different to how she learned it as well.

And a few comments around the whole issue of attitudes to maths. So Jennifer's saying that she used to be one of these people who couldn't-- she used to say she couldn't do maths, but now she's doing MST124 and she's loving it. And Pascal as well similarly has commented on the fact that lots of people just-- it's a mind set. They think they can't do maths. It's an anxiety thing, isn't it? But on a positive side, Johanna said she went to an old fashioned grammar school, and their pupils were strongly encouraged to get involved in maths. And actually, they ended up enjoying it because it was all about change in attitudes.

KAREN FOLEY: And we could change attitudes for our future generations if we were a lot more positive and applied different ways of thinking. And I think that's something that inspires so many people who want to go into teaching to make that difference and be that amazing teacher that we remember well into adulthood.

Let's take a look, Rebecca, and see what responses people said about what shape you were holding up. So here we can say that we've got different answers. We've got diamond, square, rhombus, rectangle, blue box, parallelogram quadrant, not, drunken square, rhombus a few times. Quadrilateral also. What is your response to what our audience think?

REBECCA ROSENBERG: I love it. So many different-- so many different answers. And that's great. Lots of people said square. So I think if I'd have shown it like this, a lot more people would have said a square because that's how we're used to seeing squares, with the top and the bottom parallel to a computer screen or a window, whatever we're looking at.

A diamond. Not technically a mathematical term, but that doesn't matter because we learn the shape of a diamond quite early on at primary school. And they're often presented to us like this, with the top corners and bottom corners at the top. But as I'm turning it around, you can see that the shape isn't changing. So it's a diamond. It's a square. Someone's once a rectangle. Nice.

So actually, all of those shapes are part of a polygon. And you can think of classifications of shapes a bit like a Russian doll. I've got a Russian doll here. I love props. So we've got a Russian doll. Let's have a look at the whole-- imagine that this is all the polygon, so all of the 2D shapes with straight edges. But within that, we've got all of the quadrilaterals, so all of the 2D shapes with four sides.

And then, within that, all of the parallelograms. I'm not sure if anyone on the word cloud said parallelogram, but you could have said a parallelogram. And within that, the set of all rhombuses, which is the correct mathematical term for a diamond. It's what people often called a diamond. And within that, we've got a square. So a square is a special type of parallelogram, a special type of quadrilateral. And that's one way of thinking about classifications of shapes. And that just shows that all of those answers were correct as well.

KAREN FOLEY: Brilliant. Absolutely perfect. So this logical reasoning I guess is important in mathematics, but I can also see it applying in so many different areas. Jennifer used to say that she didn't like studying maths, but she realised during S111, which is an interdisciplinary module, that she actually really liked it. So she's gone on to progress that. But some of these ways of thinking would be very appropriate in business in other contexts.

Cathy, let's go to you again and think about some of the most favourite topics of yours to teach. What do you like teaching most?

CATHY SMITH: Oh, one of the topics I really like teaching at school is simultaneous equations. And I like that because it's an algebra topic. It's got X's and Y's and equations and sometimes curly brackets. But-- and what I really like about it is it's a puzzle. You've got some information and you got some things you want to know, and you're going to use the clues, like Sherlock Holmes-- you're going to use the bits you do know to end up with the bits you don't know. So I like starting it off like that. Here's we've got some information. How can you make sense of these clues and tell me these things I want to know?

And I think Rebecca's got a little puzzle that we can show now, the kind of thing we might do.

KAREN FOLEY: Brilliant. Very briefly, Rebecca, let's look through your final puzzle.

REBECCA ROSENBERG: OK. So this is-- it's more similar questions that you might think of as typical maths questions. We've got two cups of coffee. I'm not going to stack them on top of each other because they'll fall. Two cups of coffee and a biscuit costs 3 pounds. One cup of coffee and a biscuit costs 1 pound 75. What is the cost of a cup of coffee?

KAREN FOLEY: Brilliant. So we have a word cloud there. But as you know, you probably only have one answer, although if you have more than one, you're very welcome to put that in. But do put a full stop into that word cloud so that we can see what your response is. So two cups of coffee and biscuits got 3 pounds. One coffee and a biscuit is 1.75. So what is the price of a cup of coffee?

So put a full stop in if you don't know or an X in the box if you only want to include one answer. Brilliant. So while we wait for those then-- I don't know. Do you two want to show how that relates to the algebra thing we were talking about?

REBECCA ROSENBERG: Yes. So this is a simultaneous equation question, like Cathy was talking about. And we've got props again because sometimes that can help you to see how the relationship between the two variables, the coffee or the biscuit-- the relationship between the two objects work together.

And if we've got-- we know the price for two cups of coffee and one biscuit and we know the price for one cup of coffee and one biscuit, in common with both of those equations is one cup of coffee and one biscuit. So if we subtract one cup of coffee and one biscuit from one of the equations, we can find the price of one thing.

KAREN FOLEY: Brilliant. Now, we're just getting the results of those through. These are the sorts of question, though, I find getting so increasingly complex in my daughter's homework with all of these ways of thinking about if so-and-so has these many apples, et cetera. So let's see what people at home said the answer was to your question.

Right. Here we go. 1 pound 75. 1.25 even. There we are. Is that the correct answer?

REBECCA ROSENBERG: That is the correct answer. Well done, everyone. This was one question where there is a correct answer. But I think once you've got that, there's a lot more things that you could find out from that as well. So you could find the cost of one biscuit or you could ask different questions, all or based on that one initial problem.

KAREN FOLEY: Brilliant. Excellent. Well, that has been absolutely amazing. Sadly, that's all we've got time for today, but I've really, really enjoyed our discussion, Rebecca and Cathy. Thank you so much for coming on. You're both really inspiring teachers, and it's been really interesting to think about things not necessarily being right or wrong, but the importance of understanding things, listening to people, and also, as we heard earlier, picking up on clues that are important or not important to the area of concern that we're addressing. So thank you so much for filling us in. We've got some links--

CATHY SMITH: Thank you for having us.

KAREN FOLEY: No, thank you. We've got some links in the chat as well, so if you're interested in finding out more about maths and its learning, then you can certainly have a look at the perspective and see if that's something that's right for you. It's something that people who are interested in teaching but also can appeal to students on an open qualification who may want to support their children at home also. So some very exciting options there for you.

Right. We're now going to have another video break. We're going to show you one of our other campus tours, the Jennie Lee building this time. And then we will be back very shortly afterwards to find out about the new geology curriculum. Stay tuned. See you in a moment.

[MUSIC PLAYING]