# Transcript

**Improving student perceptions of maths: the importance of personal connection with ACER’s Dr Sarah Buckley**

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Introduction:

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Click on the show notes linked to access downloadable resources discussed in this episode. You will also find timestamps for direct navigation to specific topics within this podcast.

Emma Moore:

Today, I have the pleasure of introducing Dr. Sarah Buckley. Sarah is a senior researcher at the Australian Council for Educational Research, affectionately called ACER, and she leads the project on Maths and Anxiety Engagement Strategy, which is also an acronym, MAES. So if you're not aware, this is one of three podcasts, it's the second in a series, and if you access the show notes, you can find the resources that we are going to refer to, and some research that backs the evidence that Sarah will be talking about. So Sarah, welcome and thank you so much for joining us again. And obviously some people may have just hit upon this podcast and others may have listened to the first episode. If they haven't listened to that first episode, I obviously recommend that they go back and listen to it. But could you just give me a quick summary of what MAES actually is?

Sarah Buckley:

Thank you, Emma. It's lovely to be chatting to you today. MAES or the Maths Anxiety and Engagement Strategy is something that was started at ACER in about 2018, and it was created to address what we were seeing in the maths space, which was declining achievement and declining enrollment rates and participation in maths nationally. What we are trying to do in MAES is try and stop this decline by addressing two key barriers to students' achievement, learning, and participation, specifically maths anxiety and poor valuing of maths. And the idea is that if we can address these barriers, then we can encourage students to have a positive relationship with maths and see an uptick in achievement and participation. What we're doing in MAES, which might be a bit different, is when we are trying to address those key barriers and understand how they impact on learning.

We're looking at not just educational research, but we're also looking at research in psychology and research in neuroscience, and we're looking at what best practice is, what evidence-informed strategies are out there. Some of the work that we're looking at is work that we've done at ACER ourselves, and then we are working to translate this so that it has an impact in the classroom, working with schools, with education stakeholders, with governments, with universities saying, "Here's what the research says, how do we take that and make it into a concrete thing that you can use in the classroom?"

Emma Moore:

Oh, wonderful.

Sarah Buckley:

So when we're working with schools and with stakeholders, we really are trying to look at, well, how do we encourage that positive relationship with maths by building motivation in the area? That's a really key thing that we're trying to do, particularly in relation to addressing poor valuing of maths.

Emma Moore:

Motivation is so interesting, Sarah, because I think as teachers, we use the word motivation, but what I consider motivation to look like in my classroom might be different to how other teachers perceive it in their classroom. So could you explain to us how you define motivation in your MAES strategy?

Sarah Buckley:

Yes. So there are, as you said, not just a lot of different ways that people understand it, but there are also a lot of theories out there try and describe it. We draw on the expectancy value theory in MAES to try and understand how motivation impacts on not just learning, but learning related choices, so the choice to continue studying maths or to drop it for instance when you can. So in the expectancy-value theory, it highlights a few different constructs that are key parts of motivation. This includes things like competence or confidence beliefs. So how good I think I am in maths or how well I think I do in maths.

It includes locus of control beliefs, so where do I place the control for my learning and performance in maths? You can have an external locus of control belief, so I place the control of my learning in something external to me or beyond my control. So that might be genetics, it might be the teacher, it might be nothing to do with me. Or I might have an internal locus of control belief where I believe that I have control over my learning and performance in maths if I put time and effort in. This is a perfect example of where we can have different labels to mean different things because an internal locus of control, growth mindset. External locus of control, fixed mindset. So getting back to the theory, there's also achievement goals. So what types of goals frame my learning? Is it a goal where I want to outperform others, where I want to avoid looking silly in front of other people, or do I want to master new concepts and have new opportunities to learn new things?

And then the last one that's often highlighted are values. Again, this is one that has a lot of different definitions, but in expectancy-value theory, three types of value that are highlighted are firstly intrinsic values or an interest. I do maths because I like it because I enjoy it. We can have attainment value for maths, so where maths is important for our sense of self or our sense of identity. So for instance, I value maths because it's important in my family to do well in maths. And then we have this thing called utility value, so where we're tying maths to how useful it is. So maths is important to me because of the future plans that I have for my life, whether that's careers or all the skills that I might need to use.

Emma Moore:

There's a few things that I'd really just like to pull out for our listeners at the moment. One thing you've made very clear there is that often we see these posters and signs in classrooms for a growth versus a fixed mindset. I think it's so important that we communicate to the children that they have to do something as well as just change the way they think.

Sarah Buckley:

Yes.

Emma Moore:

And that motivation to do something is really important. And of course, sometimes motivation can look like the person who wants to do the best or get to the best, but that's not always the right goal for each child. So understanding there are different goals.

Sarah Buckley:

That's right.

Emma Moore:

And that they could set for themselves and that they all have value, that that's really important, but this utility value that might be new to our listeners. Can you tell us more about utility value?

Sarah Buckley:

Yes. So really it is the amount of value that an individual ascribes to maths in terms of how useful it's going to be for their current and future plans and goals. So that can be, "I want to be an engineer, so maths is very important for me." It could be, "I know I'm going to need maths because I want to buy a house in the future and I need to work out my mortgage repayments." So it doesn't necessarily have to be for those career pathways that involve a lot of maths. It's just seeing maths as useful in your life. And we have at ACER done some longitudinal research and it has included utility value.

And one of the things that we found was that the level of utility value that students have at the age of 15 predicts whether or not they will continue with maths into upper secondary, into tertiary. And that's the thing that predicts whether STEM graduates and people in the STEM workforce, it's the level of utility value, how useful they see maths when they are 15 years old. So the takeaway from this research is there's a lot of stuff going on in the policy world about how do we get more people on a STEM pathway because that's what we need for our national economy. The takeaway is that pathway might be set in early adolescence, that maths is the gatekeeper for STEM, which all of us that love maths maybe already know that, and that we really need to make sure that that utility value is fostered in secondary school and upper primary as well.

Emma Moore:

Wow. For those of us who've not really thought about that utility value, you've obviously created a very clear picture there that this is really important and it connects back to what you were saying before again about the choices that students make. Now this sounds, this is very centered on our students, and teachers may feel limited in the impact that they can actually have on this utility value. So what are the sorts of things that teachers can do to make sure that they're really building in this utility value into the embedded everyday practice?

Sarah Buckley:

So I've done, as you know Emma, some workshops with some of the teachers that are part of the Teaching Excellence Program here at the Academy. And in talking to them, I was asking them, "What types of things do you do to encourage utility value?" And often what they said was, "Well, we make sure that the maths that we are teaching is linked to the real world so that students can see its application." And the other thing that teachers will often say is we tell students how they will use the maths that they are learning right now in their real lives. What we also know from the research is that we know that if a teacher is standing at the front of a classroom telling students why maths is useful for their lives, on average, it has either no impact on them, or a negative impact on their level of interest and learning in the subject.

Emma Moore:

So scary I suppose thinking about this from a teaching perspective, because in those moments when I always call them the Dora the Explorer moments when I ask the question, but nobody answers me. And so I answer the question for myself.

Sarah Buckley:

Yes.

Emma Moore:

So it can be really scary for a teacher to think about how are they going to support a student to make the connection themselves and not fall into that I have to make this connection so I will just do it for them.

Sarah Buckley:

Yes. And that's what the research says when they compare these two conditions where you have a teacher standing out the front of the room telling students why maths is important versus when you have a condition where students self-generate those connections because they're meaningful for them, it's the self-generated connections, they're the ones that have the positive impact. And there has been a lot of work in this space of utility value interventions.

When I mention intervention in this instance, I'm not talking about a clinical intervention or anything like that where it's basically just a task. A task that can be done that can foster those connections, that students can make maths personally meaningful for them. And these utility value interventions have been found to be highly effective. Highly effective in helping students to make those connections, and it's really focused on helping students see where maths is in their life, and making them make the connection between maths and their interests and their hobbies and their values and the things that they like doing.

Emma Moore:

Just to clarify, so we may have some listeners today who don't come from the education world, so I'll just explain that often when teachers use the word intervention, we're actually talking about at-risk students and giving them additional support, but you're talking about an intervention that should actually be philosophically embedded in the way we do things, and that's embedded for everybody.

Sarah Buckley:

That's right, yes.

Emma Moore:

Not just somebody who wasn't seeing the connections. This is a practice to embed in your everyday routine.

Sarah Buckley:

Exactly. This is something that all students will benefit from.

Emma Moore:

Yeah.

Sarah Buckley:

Even those that are already value maths, we are just going to bump that up even higher so that's great.

Emma Moore:

Yeah, and you can see how that might happen as well. You mentioned that fifteen-year-old mark. So some children who actually do genuinely love maths from the primary school, but I am a primary teacher so when I've spoken to to students who I've bumped into in the community and asked because they always share their love of maths with me, are you still interested in maths? It does seem to have dropped off at that point, even though they were genuinely good and interested then. But something has disconnected in that fifteen-year-old age range.

So I'm thinking now from that teacher's perspective, what is it we want? Obviously we need to do something to support and scaffold students to make a meaningful, personal, specific, and contextually relevant connections to what you are trying to teach in the class. I know because they're in the show notes and I was very privileged to be involved in the creation of these amazing resources that you have got. And if our listeners pop to the show notes, you'll find one called Building Connections to Build Mathematics Value. And that's the one that teachers could go to, isn't it?

Sarah Buckley:

Yes, that's right.

Emma Moore:

What could we do with this?

Sarah Buckley:

Okay, so I think firstly touching on some of the themes, it's almost like you've been worded up about this before, Emma.

Emma Moore:

I've listened to you and read your work avidly for many years now, not just this.

Sarah Buckley:

So utility value interventions, yes, they are a thing that we implement to try and help students generate their own personal meaningful connections with math. They also do require some scaffolding from the teacher, that's really important. But there are three principles that need to be upheld when you're delivering this task or trying to see this outcome. First is that the connections that students make need to be personal, so they have to be meaningful to them. It needs to relate to their hobbies. We can't just say all students like parties, so let's do something on parties. Some kids don't like parties.

Emma Moore:

My children don't like parties.

Sarah Buckley:

There you go. So what are the things that are interesting, important in every individual student's life? And that's where they've got to make that connection with math, so needs to be personal. Secondly, they need to be specific. So when they're making a connection between that interest and math, it needs to be linked to the specific topic that they're learning about. And all of that makes sense. If we know that these utility value interventions have an impact on learning and engagement, we want students to make the positive connection, the meaningful connection to the specific math topic they are currently connecting, because then we're going to see the benefits of that in that specific topic that they are learning. So that's why for this intervention or for this thing to be impactful, needs to be personal, specific to the topic, and relevant to the particular topic they're learning at that point in time.

Emma Moore:

And listening to this, and I'm thinking from that teacher's perspective and teachers love control, and obviously we can't control the personal interests of our students, but that specificity to what we are currently teaching, obviously that is in the area of our control. We know what we are planning to do.

Sarah Buckley:

That's right. Yes.

Emma Moore:

I was lucky enough to engage you for our Teaching Excellence Program, and I know that you ran some workshops with teachers so that they could think about ways where they could make sure they were not making the connections for the students, but plan for the opportunity to guide the student to see the connection. So could we talk through some examples perhaps of what we saw in that day? I know we've selected a primary and a secondary example. So a teacher who is planning a unit of work, how could they make sure that they are aware of possible personal connections to those students so that they can bring them to the forefront?

Sarah Buckley:

So in the workshop that I was very lucky to be part of, what we did was we spoke to teachers about, okay, here's this research on utility value. Here's this thing called utility value intervention. So what we essentially need to do is students need to say, here are my interests or my values, my hobbies. Here's the topic we're learning. What's the connection between these two things? We were working in those workshops with primary and secondary teachers, and there were different hurdles associated with trying to implement this task in those different settings. So for instance, for primary teachers, they would often say, particularly early primary that students might not be ready to make connections themselves. They might just not be quite there yet to make the connection, and they might need more scaffolding to do that.

Whereas secondary students, particularly in other secondary, a lot of the VCE teachers were saying this would be something that would be really good to implement at the beginning of a topic, but students don't know the maths that they're going to learn yet. And so in that instance, they need help. You need to prime them with, well, what's this topic going to include? Okay, now that I know a little bit about it, now I see how I can make this connection between my interest and the maths that we're learning right now.

In terms of examples, there were some fantastic examples that were given. It was just a joy to hear about all of them. One primary example that came out, which was beautiful, was a teacher who was saying that she thought in her, I think it might've been a Grade One classroom. She was saying that what she wanted to do was run it as a classroom exercise where she knew that she would get kids to write down what their interests are, and then she would look at addressing each one. She knew that there were quite a few kids in the classroom that really liked footy, and so she thought a fun way to do this might be to say that they have a maths machine that has inputs and outputs, and what they would do is they would push the interest in as the input, that's footy, and then it would be, I think she used the word mathsified or mathsification. It was brilliant. And then on the output would be those connections.

And she understood that in her classroom, she would need to maybe scaffold that process of getting the students to see where their connection was. So if you're scoring goals, all of those types of things. So that was one way that she thought she could do it. She was also cognizant of the fact that she would need to make sure that she wasn't falling into that thing of thinking that all students like footy, but making sure you cover off all the interests that kids have and doing it and putting it into the maths machine. Not telling them where the connections are, but with that age group really giving the scaffolding, the guided questions so that they would go, oh, okay, so when you're trying to work out what the score is now that they just scored a goal. So really guiding the students, bringing that in.

Emma Moore:

Yeah. I must admit, I was always impressed when I came over from the UK to Australia, I found myself marveling at how good some children were at the six times facts, and I wasn't initiated into AFL at the time and it became quite clear.

Sarah Buckley:

Now you are.

Emma Moore:

Certainly, became quite clear. It's like, "Oh, right, that's where that comes from."

Sarah Buckley:

That's right.

Emma Moore:

But that connection's so clear, and I even have had children who still articulate facts about six as goals and behinds because that value's there for them.

Sarah Buckley:

Right? So that was an example from a primary teacher. For secondary teachers, there were different challenges there. As I said, when the students aren't really aware of the type of math they're going to learn, particularly in upper secondary, it makes it a bit more challenging. So priming them. They also mentioned that they thought it would be good to do, even if you did it as an individual task. So getting students to write down their interests and then making the connections to the specific topic that you were studying, that it would be really good to share the connections that people made either popping them up in the wall in the classroom, putting them in a Google Doc, something like that, so that students can read other connections that their peers have made because that could resonate with them or that could make maths more meaningful for them.

So one of the things that the utility value intervention research has also showed is the importance of prosocial values. So we can value maths because our peers find it useful. That can be a meaningful connection for us. So if you see on the wall that your peer is using this maths that we're learning and sees it meaningful for them, that might be important for making you more likely to get on board and value that topic.

Emma Moore:

That's really interesting actually, because you mentioned this, I don't want to make it sound like this mythical age of 15 years old where something happens, but what I have noticed in my own experience is that there's a shift in where your motivation or your justifications come from in that age where previously it's been very much about what happens at home and your parents, and suddenly around that age, what your friends think is so important and would trump anything that goes on at home and that bringing some children out of their shell to see that connection, that would be so powerful. Because you're right, they will see the connection. They will make that, and it's a social connection. A social connection is everything.

Sarah Buckley:

Yes. What we see in the research is as you were talking about before, we see a decline in motivation, sometimes upper primary, but also in the early secondary years of motivation. Early secondary is when we see maths anxiety peaking. And also it's that time where we do see that shift, where we see that academic motivation and engagement is much more likely to be shaped by the peer network that I'm in, versus the ideas, beliefs, support that I'm getting at home. Not to say that they're not influential, they're very important.

Emma Moore:

They would be the foundation on these future relationships would be built.

Sarah Buckley:

That's right. One thing I'll say about working with the wonderful teachers on that that were in the TEP was that one of the VCE teachers that was part of one of the workshops said that she would use the activity of making these connections. She would do it at the beginning of every topic and perhaps at the end of every topic as well, and several times whenever you're introducing a new topic, but also that if you did it at the start of the year, it would be a fantastic way to really gain an insight into what your students are interested in. It's an icebreaker in that way, but it's also useful for planning throughout the rest of the year when you're trying to think about engaging students.

I think even though we're talking about utility value interventions and how self-generated connections that a student makes are really fundamentally important for their persistence in learning with maths, that doesn't discount the importance of real-world application and designing tasks and lesson plans that might include some of those interests. And this task as this teacher was highlighting, is also an opportunity to really gain some information that's going to help that process too.

Emma Moore:

It sounds as well that that could be a really useful planning tool, reflection tool for both yourself and the students, but what a wonderful way to activate prior knowledge as well. And when things are forgotten because they are young and they have other things going on in their lives, a great way of reconnecting each time something is brought back in. So you've got that retrieval and that memory process going on as well, because you have this live document or display constantly evolving.

Sarah Buckley:

Exactly. And as they're moving through the topic, they can add connections to the posters on the wall or to the Google Doc, so they understand that that's going to change and evolve. I think that's really important as well.

Emma Moore:

It would be wonderful as well if a child who had not made a connection went away and just saw something and thought, maybe I'll just think about that one and maybe play with something they hadn't played with before.

Sarah Buckley:

That's right.

Emma Moore:

And make that connection again through that peer and just exposure that this is maths as well.

Sarah Buckley:

Yes.

Emma Moore:

That's wonderful. So Sarah, so many awesome examples and wonderful ways where the teacher can take that control, but I really want to highlight these amazing resources that ACER and the Academy of Teaching and Leadership have developed. And can you just talk us through this building connections to build mathematics value, please?

Sarah Buckley:

Yes. So the particular resource that we're talking about here is really just how do we take this utility value intervention research and make it work in the classroom? So the research that we've talked about today is summarized in this resource that you mentioned so that teachers have that there to access. But the second component of the resource is really saying, okay, how do we take this and pop it into the classroom? It emphasizes what are the principles that all utility value interventions need to have in order to be rigorous and have that positive impact. But then it says, how can you adapt it for your particular context?

So I mentioned before what might need to be highlighted in a primary school application versus in a secondary school application. So all of the resources that have been developed recently in this partnership between the Academy and ACER are focusing on that secondary space, but they're also equally applicable in the primary setting as well. So yeah, the resource is just there to guide teachers so that they can see, have some information on, well, how do I make this work for me? What are the bits that I really need to include to have that research fidelity? But then what are the bits that I can adapt so that it works in my context?

Emma Moore:

That's really important, Sarah, because obviously our context is very important, so whatever setting that you're working in, obviously you have to honor that setting and no one knows the students better than their teachers, so making it relevant to them. And obviously, as we've already pointed out, this is a very personal specific utility value. Do you think as well, it's really important that transition phase from later primary into high school, and that's something that I think is wonderful in the Teaching Excellence Program is that we actually get to work across the whole primary and secondary range and just making teachers aware that those collegial conversations between primary and secondary teachers are really important, making those connections. And there is plenty of research as well for those listeners who want to go away and deeply read about where this all comes from. They can look at those research links at the end on that resource as well.

Sarah Buckley:

Yes, they can. But yeah, as I said, a lot of the research that we've talked about today is summarized in that resource so that the work that teachers are doing, they know that it's evidence-informed.

Emma Moore:

So you've done the work, so we don't have to.

Sarah Buckley:

That's right.

Emma Moore:

I like it.

Sarah Buckley:

Well, we've done it in partnership, Emma.

Emma Moore:

Well, we have, but our listeners can go away knowing that we were thorough and that this has been very carefully considered. Just reflecting now back on our conversation, I'm going to highlight my three key takeaways, and then I'm going to ask you for yours. I'm going to go first so I get the easier job. So Sarah has to work harder.

So my key takeaways here is the personal connection and the students must make their own. And even though we think sometimes as teachers we're speeding things up, we must try our hardest not to do that for the students and allow that time, let them make that connection. And leading from that is the fact that of course, teachers can't do that. But what we can do is plan to include connection opportunities. My third one would then be linking again to that is that you must then plan to collect information about your students, and purposefully find out what they're interested in. So as the teacher, while planning, you are planning to put the opportunity for connection in front of our students. That involves building a really strong positive teacher-student relationship, which I'm sure our listeners are very aware of the importance of that relationship.

So just to reiterate, because I do like to do that. So personal, connections cannot be made, teachers can plan for those connections but not make them, and that the teacher-student relationship and the collecting of those interests are key to making this possible.

Sarah Buckley:

As you said, that third and that second one link. You understand what their interests are, then you can do a little bit of pre-planning to know what the connections might be to the particular topic that you're studying, and just be there to scaffold them gently in the direction that they need to go so they can make that connection, which was your number one. They're very good takeaways, I don't know how I'm going to top them. Maybe just to say that students can value maths in lots of different ways, and all of them are useful for learning. What we've highlighted today in our conversation is that the amount of utility value that students have for maths, so how useful they feel it is for their career or their goals, for their skills, for their daily lives currently and for the future, it's so important and predicts whether or not they will persist with maths so that's really, really important.

Secondly, that these utility value interventions that we've been talking about do evidence informed. So it's really important that we do keep those three principles when we are running a task in the classroom so we have that fidelity. So as you said, connections need to be personal and meaningful for each student. Secondly, they need to link to a specific topic, and thirdly, they need to be relevant to the topic that students are talking about. And then my third point, which I'm finding difficult, because I feel like Emma, you've said all the good ones.

Emma Moore:

How about the third key takeaway would be make sure you go to the show notes and access the resources that have been developed by ACER and the Academy of Teaching and Leadership?

Sarah Buckley:

I feel like that is a perfect third one. Thank you so much, Emma.

Emma Moore:

Excellent. Thank you so much for joining us today, Sarah. It's been an absolute pleasure to talk to you.

Sarah Buckley:

Oh, it's been my pleasure too. Thank you, Emma.

Outro:

We hope you enjoyed this Academy Podcast episode. You can find out more about our upcoming professional learning opportunities at academy.vic.gov.au and follow us on social media to stay up to date.