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CPL Podcast: Why and How to Teach Mathematics 7-12

Host: Carly Boreland
With: Eddie Woo and David Watson

INTRODUCTION:
You are listening to the JPL Podcast from the Centre for Professional Learning. Here's your host, Carly Boreland.

Carly Boreland:
Welcome to the JPL Podcast for the New South Wales Teachers Federation Centre for Professional Learning. I'm Carly Boreland, and I'm the Editor of the JPL. Today, I'm talking with Eddie Woo and David Watson, and we're chatting about what it's like to teach Maths in high schools. And we're going to cross a few different topics, so hang on for the ride, and we'll see where we end up. Eddie, David, welcome.

David Watson:
Great to be here.

Carly Boreland:
Look, we want to talk about big things. So there's some changes that have been going on in Maths for Year 11 and Year 12. There's new syllabuses. We've had a suite of syllabuses now from 7 to 10 as well. And that's taking up lots of teachers' time and energy and effort at school. But I wanted to start, before we talked about those more pressing things, with what you love about Maths and why you came to be Maths teachers. And I ask that as a History teacher who would not necessarily feel comfortable in a mathematics classroom teaching it, but I know that that's what you've both chosen not only to make your careers but your passion as well. So could you start us off with why Maths and why it's a good time to be a Maths teacher?

David Watson:
Yeah. I'd love to go first. I became a Maths teacher because of my Year 12 Maths teacher. And he probably followed on the back of my Year 11 Maths teacher. They were just really good at explaining what they were doing. They didn't necessarily do anything that I do now, but I guess they just engaged me in it. They came across as good people who cared about good things, and I guess I developed a connection with them. The reason I want to go first is because it changed since working with Eddie. Eddie and I worked together for two years. And in that time, I really reflected a lot on the way that I teach not just because of meeting Eddie, but meeting a whole bunch of different kids there and from meeting Eddie and working with Eddie really closely and thinking about, I guess, why we want kids to learn the things they do, the power of exploration in Maths, the beauty of not having just right answers and everything.

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Eddie and I have done so much exploration of things, which I'm sure he's done on his own and with others as well. But it's really changed the way that I view it, not that I look back on anything I did in my early years as being wrong, but that I would definitely do them differently now. And it's mostly because of a different focus, I suppose, and trying to think of what we want our kids to become. And I really enjoy how we can relate it to not just Maths. And by that, I don't mean getting Maths and relating it to a problem that's real world. I mean things like kids taking risks in Maths and sometimes their adversity to that and how that is really very similar to the way that they are in their lives, their social interactions, and they relate their confidence in Maths so closely. If they feel like they're good at Maths, then they feel very confident in themselves. And yeah, I guess I've just enjoyed exploring that. I think that's been a really interesting transition for me.

Eddie Woo:
I love listening to everyone's stories about why they became teachers. And David and I, as you mentioned, have worked so closely. It feels like we-- I know David's story really well, and I would describe it as a story that makes sense. There's a progression, and it's like, "Yeah. That logical," because he had strength and he had good models that sort of headed him in that direction. I guess, by way of contrast, I would call the reason why I became a Maths teacher a story that doesn't make sense. I mean, Carly, you're a History teacher. History and English were my favourite subjects at school. They were the ones I kind of just naturally tended towards. And I didn't mind Maths. I certainly had excellent teachers who did a fantastic job explaining things very clearly. But it just kind of never gripped me, and it was just sort of there at the periphery.

But when I arrived at university, I learnt about something we're probably going to come to later in the conversation, which is that for the last, I don't know, 20 years - and I feel it hasn't changed since then - there's been a critical shortage of Mathematics educators in Australia, and I've since learned really all around the world. And when I realised that I could do something about that shortage, that this would be an area of need that I could contribute to, I thought, "Well, you know what? I wasn't bad at Maths at high school. I will give this a go. I'll struggle my way through it because that's the way I experienced it at school." And very much like David, I went through a huge transition at university and in my early years as a teacher. I guess I was really won over by-- Mathematics is the language of patterns. It's the language of solving problems, and that allows us to appreciate the world around us.

And also, it enables us to function more effectively in our world when we understand all these numerical realities around us. So being the person who, I guess, opens that door or unlocks that ability that children can then say, "Oh, this is a part of the world that I can grapple with and can understand. It might be hard, but once I get there, I'm like, 'Oh, this makes sense,'" that is such a gratifying experience to be able to-- I'm sure Dave has had the experience many times. When you teach a student and you see that moment of realisation click in their mind, it's quite different to when I learn something in History and I think, "Ooh, that's interesting," or, "Oh, that's surprising." In Mathematics, it's like, "Oh, this makes sense of something I've experienced my entire life, but I've never known why." So I love seeing that all the time.

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Carly Boreland:
Can I ask you then-- because you both have this love of Maths teaching now, and you're clearly fabulous at it. And some people have seen you teaching Maths, obviously, on the internet, and you both present CPL courses for us, and you're so highly regarded. So you're wonderful Maths teachers. You love Maths. It's a great subject to teach. What's going on with this shortage that you were mentioning? Because it doesn't quite-- what's going on? Do you know or do you have an idea of why?

Eddie Woo:
I think I can jump in. I mean, there's many reasons--

David Watson:
Please do.

Eddie Woo:
--many, many reasons. I'll start with one, and then I'll hand it over to Dave (LAUGHTER). I think the most apparent reason is, if I think back to when I was at school and any of my friends who had serious mathematical chops and were skilled in that area and could, therefore, look at a profession where they might use that, they would go into engineering or finance and actuarial studies, frankly, a place where they could make real money, not education. And so those skills were, and still are, in high demand. And so I think it's just in some ways, probably, the 800-pound gorilla is that economics says where people are going to go. And so long as teaching remains in this country a relatively humble profession, I don't see that changing dramatically.

David Watson:
Yeah. Maths has a bit of a bad image amongst students, amongst the community sometimes, some of the parents that we speak to as well. A lot of people question its relevance when you're teaching it to high school students, and I think that would change just a lot of people's perspectives. And as Eddie was saying, a lot of people would go into engineering or advanced science fields. When I studied, I studied advanced Maths at university, and what else do you do with that degree? And so while I kind of had an open mind that I might do something different, it wasn't an education degree. It was a Maths degree, and then I did the education after. So for the whole three years, I was doing the Maths degree, I sort of had in my mind, "Maybe I'll go into something else." I did do another job for a good month (LAUGHTER). It was—

Carly Boreland:
Stuck it out.

Eddie Woo:
Yeah, yeah, yeah, yeah, yeah.

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David Watson:
It lasted a whole month (LAUGHTER).

Eddie Woo:
That train trip killed me. Yeah. There wasn't enough podcasts in the world to keep it going. That was before podcasts, but anyway. Yeah. I went along (to that?) for a little bit. But realistically, I was always going to try out teaching, which is amazing because-- that was what I was saying before. What I thought a teacher was and what I thought good teaching was and good Maths education and things was not what I think it is now. So for that to have been the idea the whole time is quite interesting. But yeah, I think a lot of people that would go into that level of study of Maths, there may only be one purpose for you doing so. And I guess other subjects might not have that. I guess there are people who would go into other fields and then find their way into teaching. I'm not sure. It's a very difficult one to answer why people don't because, I mean-- I don't know. Do you feel that in your teaching, in that area (CROSSTALK)?

Carly Boreland:
I don't think it's a thing.

David Watson:
(CROSSTALK).

Carly Boreland:
I don't think in History it's a problem in the same way that it seems to be in Mathematics. I think there's lots of keen History teachers out there and lots of really great young teachers coming through as well. So I wanted to ask you a bit about, I guess, youth and experience and age. And you said that your experience of teaching, and what you think is a good teacher, has really changed over time. Can you tell me, I guess, separate from being a Maths teacher, what's great about being a teacher? What are the things at school that are so fabulous?

David Watson:
That's a very good question. I'm going to go down the path of just saying the students straight away, just the students and their-- I'm not going to say blank slate -- but the canvas that we have to work with, and what they can create, what they can become. The challenge is obviously a huge thing as well because students of all ages and all sizes-- so we're lifelong learners. Adults out there everywhere are learning new things all the time. We see what we want to see sometimes. We hear what we want to hear sometimes. That can extend to things like feedback, the actual content that you're teaching, the way you're teaching it, the way you facilitate something, the way you design an activity. And that challenge of thinking of everything to make sure that you get the desired outcome you're after is a really engaging thing, I guess, for us to engage in our profession and what we're doing.

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Carly Boreland:
So it is hard intellectual work to make sure that happens.

David Watson:
Oh, yeah. Yeah, challenging every day. I can't imagine a teacher would ever say that it wasn't, that it was ridiculously easy, which is a good thing in that no matter how well we educate our students, we always want to do it better.

Eddie Woo:
I think Dave has nailed it in, one, first, that students is absolutely-- like the relationship, the transformation you can see particularly-- I mean, we're in high school. I think a similar kind of thing happens in primary but in a different way. But when you see a kid go from age 12 to age 18, it's no exaggeration to say that that change is profound. And a lot of children throughout that time will-- I mean, and this sounds crazy to say, but having come from-- I just recently spent a week in Africa, where education is not like it is in Australia, something that you expect to get, particularly, not at secondary level. I think that we often forget that from age 12 to age 18, many children go through this change not just in their ability and knowledge but in their self-concept. They realise they are capable of things that they thought were impossible. And we, as teachers, get to see that happen hundreds of times a year, over and over again, and it's new every time. And to be able to say, "Yes. I knew that. I saw that in you five years ago. And I've been working and labouring to cultivate that in you, but only you could grow into that kind of person, that kind of person who's going to have that desire to make a difference in their community or use their skills to serve people in a place where they can make a real difference." That's amazing, definitely.

I guess, I'd add to that I know the-- Dan Pink, he's this sort of psychologist and researcher, and he does a lot in human behaviour. And he talked about why people enjoy work when they do enjoy it, and it's when they have work that gives them the ability to have autonomy, to gain mastery and where there's a clear purpose. And for all the syllabus documents and the requirements that we have, teaching is an amazingly autonomous kind of profession. You have so much latitude to think creatively about what are you going to do in order to craft a learning experience for your students that is engaging and interesting but also helps them question themselves and the world around them. You get to choose. And every time I've taught a course, I get to teach it differently and explore new ways of doing it. That's really exciting. So autonomy is a really enjoyable thing to have, but also that sense of mastery. I think everyone likes getting better at doing something.

We've been teaching for more than 10 years now, and over that time - and we're still doing this as lifelong learners - we've become better at understanding children and adults and working out how do you talk with people, question them, make them think. And we grow in that, and that's gratifying, myself. I mean, it's a bit horrifying sometimes. I look back at videos of when I was teaching five years ago because they're all there (LAUGHTER). And it's just as irritating listening to the sound of my voice, but it's also incredible to see how much I've changed as a teacher. And lastly, that purpose of we

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do this for a really clear reason. We serve these children. We affect our communities in a positive way. That's a great privilege.

Carly Boreland:
You made me think about-- now that I work at the CPL -- I meet thousands of teachers every year. And in the last couple of years, I've had the good fortune of meeting a few students who I taught when they were in Year 7, and now they're teachers. And when you were saying you know them since they were 12, I thought, "Oh my goodness. You're my colleague, but I've known you since you were 12. And your ideas about how you'll be as a teacher are from me when I was really starting out and learning, myself, how to do things." But it's such a neat experience. And it must be pretty unique in the world to have that, and to have those people who are now literally your colleague and making amazing differences. And you see them, and they've only been teaching for two years or something, and they're already fabulous. And you just think (with awe) like, "Oh, I was not that good (LAUGHTER). I know I was not that good when I first started." It's so nice.

So you've been teaching for about 10 years each, about the same as me, and you're both head teachers, similar to me. I want to talk a bit about that, what it is like to be a head teacher, what it's like to have been in this sort of generation of teachers.

Eddie Woo:
I think the first thing I'd say is that it's a really hard slog but a wonderful privilege to be someone who gets the opportunity to lead people and curriculum in a school. It's a great gig, with all the challenges that come with it in terms of the ability and the opportunity you have to affect the learning of hundreds, thousands of children over the course of many years. I came to realise now, many of the things that I experienced as a student, like what I thought mathematics was, came from decisions and policies that came from philosophical beliefs and convictions about what Mathematics is and should be. And I just kind of took on that view because it sort of came from the head teacher guiding their faculty in a particular way to say, "Now, these are the things we value about this subject." It's not just about their ability to calculate things fast. It's about their ability to understand phenomena and explain that. So I think that's fantastic.

But at the same time, I have genuine concerns, particularly in our field in Mathematics. There's some brilliant leaders out there, and I love meeting excited new leaders or experienced ones who have been doing great work for many years. But at the same time, there is a real cavern, a sort of a vacuum of mathematics leadership that's retiring. It's moving out of the profession, and it's not being replaced as quickly as it's disappearing. In some ways, it's why both Dave and I became head teachers at relatively young ages because there was need. And we were willing to put up our hands and grow as we did that job. But yeah, it's something which we both feel really strongly about, that we need to do what we can to strengthen the profession because the perspectives and understanding of children around the state and the country depend on it. So it's something that I know we're really thinking about quite consciously.

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David Watson:
Because it needs change. It needs everything that Eddie is talking about. I guess I would agree with Eddie about how we both got into the leadership profession of Maths teaching quite quickly. And while that's been a wonderful privilege - we've learnt so much - I've been a head teacher longer than I was not a head teacher (LAUGHTER). And that didn't take very long. And I learnt so much through mistakes, which is very quick, which is cool because you end up at a good place quite a lot faster. What we want is as much example of good practice as we can find. I find that being a head teacher, it's always a challenge, as is just being a teacher. I think the only real difference is, I guess, you just add-- it's almost like you add a class to your load because-- Eddie was talking before about autonomy, mastery, and all those things, and he was talking about it in our profession. And I found it quite interesting to listen to and think about how that's the kinds of things that we also think makes our classroom successful, when kids have choice when kids have the opportunity to be successful. These are the things that make our classes work.

And we often look at it in the reverse as well, that the things that make a good class also probably make a good team in our faculty. And I guess there's just a lot of practices that change due to policies, and there's also practices that change just because of research and things we discover. Both teachers in our teams, and ourselves, need to be flexible. But I guess what our job ends up becoming is also being willing to acknowledge the situation for what it is and not, I guess, what we want it to be-- rather, looking at teachers - what they can do, what they're used to doing, what their habits are, what my habits are - and how to make it so that it can be the best thing it can be for the kids, and before any of that, identifying what is the best thing for the kids. All of that is a really interesting challenge. You learn a lot about psychology, I suppose, and as much about yourself as about your team or the kids or anybody like that. Yeah.

But as Eddie said, it's something that, yeah, we're pretty committed to making sure that there's opportunity and support for other people who want to get into that kind of profession. We really think that there is a need there and that the people who do get into that profession need to be supported because teaching is hard at any level, and head teachers certainly are no different. And one of the things that I would think about that was really helpful for me being a head teacher early on-- obviously, I talked about Eddie and I working together, and we were partner head teachers, which was fantastic. But even before that, at my first school, I was lucky enough to have a head teacher there who was the head teacher of numeracy. And I've always found that you really need friends in this profession no matter where. And a friend in that light is a person who cares about the goals probably as much as you do, whatever it is you're trying to achieve, cares as much as you do about that. And that's hard to find, but I think that's a really important thing, to me, to find. And yeah, I definitely encourage anybody else to do the same thing, for sure.

Eddie Woo:
I'd love to add to that, just that you referred a little bit before about that. Why is this a good time to be a teacher, to be a Maths teacher and to go into Maths leadership? We couched it in the terms of the

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struggles that we do have. But at the same time, I feel like we're at this exciting point. I see two points in my mind. We're sort of at this inflection point of where our society-- if you rewind a few hundred years, right, literacy was obviously not commonplace. If you were a normal person, you couldn't read, you couldn't write because how could you? You had no access to the education. Or even if you could be educated, what are you going to read? Only the rich people can afford to hire a scribe to write something or purchase a book that took three months to write. And then the printing press changed everything. And of course, now, from this point of history, we understand if you go into the world without the ability to read and write, as sadly many people do, it's like trying to function in society without hands and feet.

The ability to read and write is fundamental to our ability to interact with others, to understand our world. So we get that, and that's why we prize literacy. But we're not yet there for numeracy. We still think of that as the domain of special people. 500 years ago, they would have said, "If you want to be a scribe, sure. You read and write? Good for you." Right? And now we say, "You want to be an engineer? You want to go into science or something like that? Sure. You special person, you go and do mathematics." Right? But we're sort of at that point where we're now realising - and this comes to my second point - we're in this world that is awash with data. I was on my way walking here. I passed by a bus stop which had a poster on it. It was a Facebook ad; an ad by Facebook. And it said, "Fake news is not our friend." That's what it said. And what it's referring to, is that we live in this world where we're swimming in such a sea of data that we sort of entrust ourselves to these big technology companies to decide what we're going to see and hear and read--

David Watson:
And believe.

Eddie Woo:
--and believe. And so if we don't understand-- if the Facebook algorithm and Twitter and Google and everything they're doing with our data is something that we don't have the tools to really comprehend, then we're just going to be pawns in someone's game. And so we're at that point where it's like, "No, no. We could really take off." We can look around the world now and see, "Yes. Mathematical understanding is valuable and it means something." But we haven't yet crossed that point where we're all on the train and growing in that area. So that's why mathematics education is so important.

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Carly Boreland:
Can we try and draw it together, a few things that you've been talking about? Because we've been talking about some of the challenges and struggles in Mathematics specifically, but at the same time, all of these wonderful things about being a teacher. So could you try and describe for us some of the things that you think would be great to try, in a way, things you wish you'd known when you started teaching, about things you could do in your classroom that you'd like to encourage other people to maybe give a go to, to sort of bring Maths alive and make it something where our students feel like they're excited, they're curious, they're eager, and that maybe even that becoming a Maths teacher is for them, that it's that good to be in a Maths classroom?
And I wanted to try and do that by just using some of the words you talked about already. So you've talked about flexibility and autonomy. You've talked about exploration and taking risks and being confident. And if I just go with those words, to begin with, what does that look like in Year 7? Or what does it look like in Year 9? Can you tell us about some lessons you've tried that have been okay? We won't say they worked because I think that whole what works thing can sometimes turn people off, but things that worked that the students seemed to like, and you think they learned something really worthwhile from.

Eddie Woo:
Well, I think, as Dylan William likes to say, "Everything works somewhere, and nothing works everywhere," so the important thing is to ask, "Well, under what circumstances does it work?" which means you need to try the best range of things. I think probably one of the things that comes to my mind immediately is we've been talking in the Stage 6 Syllabuses about, for the first time, we have mandated what the school-based assessments-- what form those are going to take. And the idea of using investigative-type assignments and tasks and research tasks in Mathematics, which is making a lot of people nervous, but for me, just sounds like an opportunity. We talk about the importance of connecting students' learning in all areas, not just Mathematics, but especially mathematics, connecting their learning to their own context and showing the relevance of that.

Now, I'm convinced a lot of what we try to do in making learning relevant isn't real-world learning. It's what Dan Meyer loves to call fake-world learning. It's, "Yes. David was buying 47 watermelons at a cost of--" and that's not what-- I mean, watermelons, cucumbers, whatever food you want to eat. That's not really something people would do in the real world, and they certainly wouldn't try to solve a problem like that by forming a set of simultaneous equations. So it ends up being a very contrived and artificial application of Mathematics. What I think might be a good place to begin is to say, "Well, let's find a local issue, a local problem, something that's pressing on you." This comes to that purpose idea before like, "Why am I doing this? Why am I doing these 50 exercises in my textbook?" The purpose is to develop a skill to be able to solve a problem that matters.

For example, we were doing this project at our school a few years ago where we were redesigning, relandscaping, part of the school playground. And because it's their environment, they feel very strongly to it; they feel tied to it. And suddenly, they are trying to solve problems, for example, "How

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much would it cost if we were going to cover this entire area in AstroTurf because the grass can't grow there? Well, we need to be able to know its area. Well, it's a weird, wonky-looking shape. It's not a rectangle. It's not a circle. We need to find a way to do this." And suddenly, they now have a context and a motivation intrinsically to say, "All right. Well, let's cover the area of composite shapes." They came up with that, and now we have a reason to go forward. And so I think whenever we can, coming up with a problem, letting students be the ones to pose, "This is the context in which we want to apply Mathematics." And then for us, as teachers, to say, "Okay. Well, I'm the one who has the content knowledge to point you in a helpful direction for you to start growing to be able to solve those problems." That's a really powerful instrument to use.

I really do think this can work in a variety of contexts, even all the way from primary all the way up until Year 12. But the instance I just gave, I mean, kids in Stage 5, they're starting to deal with some fairly complex shapes. They know about lots of formulas for the areas of various plane shapes. And what do they do with them? Well, they identify questions in a textbook, and they say, "It's that shape," or, "It's that shape," and then they apply the formula from memory. And it's like, "Great. You evaluated that." So what?

And, so being able to say to those Year 9 and 10 students, "Actually, now you've got a real context to put that into. You come up with the shapes. I'm not going to give them to you in a textbook. You're going to have to work out a way to-- there's this brilliant problem of 3D projection. It'd be great if you had satellite photography of every spot you needed to measure out. But actually, most people do not have a satellite they can just call on that'll take a picture of an area."

"But you have a perspective whereby if you stand on the ground-- you can actually think about this and visualise it. If you stand on the ground and look at a rectangle like a basketball court that's sort of spreading out in front of you, it doesn't look like a rectangle to your eyes. It looks like a trapezium. The edge of the basketball court close to you is nice and long. And then off in the distance, it's really short because it's far away. And those lines converge. It looks like a trapezium. How do we come up with that as a rectangle? Well, actually, there's heaps of cool mathematics that looks at stereographic projection to explain that." And I just came up with that because that's what a student would do. They'd be like, "I'm solving a problem. I don't know what's the Mathematics that applies to this. Can you help me?" And once I sort of head them in the right direction, they've been nudged, and now they do the work. And that's what makes it so successful.

David Watson:
I think the other point that I really want to make is that ideas like that are really cool to get them the concept, to get them interested; to get them maybe interested investigating those kind of things. The next place I'd want to go to is now we have this-- now we have some sort of goal. One of the activities I've done particularly with gifted students from Stage 4, 7, and 8 is to be given a particular area that-- oh, actually, they don't get given the area. Sorry. They're told that they need to put a fence around a certain number of Maltesers which we're actually going to pour into the container they build. So they've

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got to come up with the area. They've got to come up with the perimeter from that, I suppose. We tell them that we want them to minimise materials, and they've got to come up with what they believe is the optimum shape. There's a little bit of competitiveness there, which is a little bit dangerous, I suppose, because you want everyone to-- like I say, you want everyone to experience some degree of success. But they do tend to enjoy themselves when you're pouring it in and all that kind of stuff, which is cool.

But I do think that the point that is really worth making here is that Maths is also about communication. There's a lot of language in it as well-- or it is about a language. It's an entirely new language in a lot of ways. And so activities like that are fantastic, but there are many components that go to it. And I'm sure a lot of teachers would hear ideas like what I've just suggested and been-- I hope no one will be saying too much about, "Yeah, but then they've got to do a test." Because I don't think that's a reason to do it a different way because maybe they don't have to do a test. Why should they do the test? It should be a way of assessing whether or not they've learnt stuff. But there's a reason we tend to do a lot of tests and things. It's because we expect kids to be able to communicate things.

And while they may get a good understanding out of the activities I'm talking about, there needs to be good things around that to make sure that they can then communicate that understanding to someone else as to why different areas would come from different perimeters and possibly even solve traditional numerical problems that go around that, whether that be-- maybe they can't do it in a traditional test sense, but we need to give them multiple opportunities to do that. And I'm sure a lot of people would listen to some of the examples I just gave and see that kids would have a very good time, but not necessarily have that opportunity to demonstrate this deep understanding by saying, "Well, this is why it happens." They might just go, "Oh, wow. My Maltesers fit in!" And you want them to be able to go further than that too. So that's not the only consideration, because you want them to have that curiosity, and we have to instill that in them by making them care about these things, giving them opportunities to care about these things.

Carly Boreland:
It is funny how you talk about our ideas about assessment and how much our assessment drives whether we'll be up for trying something out or not, because I can think of lots of ways that you could assess all of those skills. Maybe it's a pen and paper type of task. Maybe it's a conversation. But when we kind of pin ourselves down with the assessment, it really does influence everything else that we've got to do. I was talking to a colleague recently. He's a Maths teacher in Denmark. He was just saying this week, "I've got an oral assessment for Mathematics." And it was like a casual, run-of-mill, not surprising at all, totally normal part. And I was like, "Really? An oral for Maths? I didn't even know that was a thing." Are there things we could be trying that are actually not that experimental, that are pretty well done in other places, and it's just that we've got some sort of mindsets around testing?

David Watson:
Do you mean New South Wales?

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CPL Podcast: Why and How to Teach Mathematics 7-12

Carly Boreland:
Yeah. (INAUDIBLE).

David Watson:
Yeah. I don't know about other places doing really well. I have heard some good things, and I think I've heard some good things that Eddie knows about as well, like from Queensland and those kinds of ideas. But absolutely, the things you're talking about now-- I mean, why not have kids be able to speak things. If you had someone who was awful at writing not just essays but just writing in general, but they were a fantastic speaker, that doesn't change the fact that they're not good at writing. But it does have an impact on-- when you were to judge them as a communicator, yeah, there's two-- or there's probably more components to that than just speaking and writing, but there's ways that kids communicate in that. But I think one of the main themes that we have nowadays in our dialogue is about giving kids opportunities to demonstrate what they can do. And the best of them will be able to perform in all ways, but for many of them, they may struggle with one particular type. And yes, it's true. For Maths, we have assessed in one particular type, and we've let a lot of what we're doing as teachers be dictated by that. And it's actually a really interesting process to stop yourself from doing that. But there's definitely people doing things in other places. You've told me some fantastic stories, I suppose.

Eddie Woo:
Well, I mean, yeah. I think it's wonderful. And it speaks to the fact that Mathematics is far more diverse than we often take it for. And, I mean, if you even call back to-- if we rewind the clock a few decades and talk about what did people feel was important to a basic, fundamental education, people would say the three Rs - reading, writing, arithmetic - which, firstly, is self-defeating because one of the Rs is a W, and one of them is an A (LAUGHTER).

But more fundamentally, if you ask someone on the street, "What is someone who's good at Maths?" people would mostly think of people who are good at arithmetic, which is adding, subtracting, multiplying, and dividing. And I remember one time I was setting up an example, and one of the teachers who was there said, "Hey, Eddie. We've got to work out how many tables and chairs. What's like 16 rows times 16 columns?" And because I've just spent most of my adult like doing Maths all the time, I happen to know that that's 256. And he was so blown out of the water. He was like, "How did you know?" I answered instantly. And that shouldn't be impressive because arithmetic is actually no big deal. Mathematics, when we talk about working mathematically, as in the Stage 6 Syllabus, that looks like 6 things: communicating, understanding, fluency, problem-solving, reasoning, and justification. That is way broader than, "I can just calculate stuff, and I can do it accurately, and I can do it fast."

And having a diversity of range of assessments, whether they're oral presentations or writing a paper or conducting research and coming up with conclusions that you can explain and that you can back up with evidence that's mathematically reasoned, what that speaks to is that if we said, "Are you any good at Music?" and what we did to assess people on whether they were any good at music was we made them all play exactly the same instrument. It's like, "You know what? Saxophones for all of you. If

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you're good at a saxophone, you're a musical person. If you're not good at the saxophone, then forget it." We inherently recognise that that's a very narrow way of looking at such a broad and beautifully diverse field. But Mathematics is actually just as broad as music. In fact, Mathematics and Music have this great, wonderful synergy. Right?

And so when we think about Mathematics, many of the areas - I'm talking about numbers, right? - significant parts of mathematics have nothing to do with actually being good at those areas, have nothing to do with the ability to calculate. We're talking about the inclusion of statistics in the calculus courses, which is causing a lot of people angst because it's such a big, new idea, and some of the ideas are quite complex as well. But the way you think, as a statistician, is very little to do with the actual calculations. We have machines to do that for us. We're not so much concerned with the answers so much as we are concerned with asking the right questions. That is a whole different kind of skill, and developing that, is what it means to grow mathematically. And so that's why it's really important to assess in a diverse range of ways.

Carly Boreland:
From what I'm getting as a picture, we've dealt with Year 7, Year 8, Year 9, Year 10, and basically, you're often taking them outside. But when you get out there, you're not just calculating how many wombats are out there. You're trying to do something much bigger than that with students, and that's getting them to think. And so there's something we could probably all learn from that about what Maths is.

David Watson:
I think we talk about knocking down the four walls as well. So it's not so much necessarily taking them outside as much as it is-- some of the best work that I've seen done, and I'm sure this was mathematically minded. There's a school in Bankstown that was doing a project with a school in Texas that's online. The information, the intrigue, and the problems, they're analysed from all over the world. So it's not necessarily just that. It's also a lot of the best work - Eddie mentioned Dan Meyer before - is just like short clips videos. That's what he's done. He designed a whole bunch of videos that just sort of are supposed to intrigue students. So that's what gets them into the idea of everything. We had a really interesting discussion about that and where the kids would actually go, because one of the things I think we really need to go towards now is really putting purpose into things. If want kids to experience that success, as I say, just being able to have those kinds of things readily made by other people that just start us off on a bit of exploration. There's some really, really cool things out there that we can access. So I think it's probably not very accurate, certainly not for me, to say that I take my kids outside all the time, but I think it's a very, very good thing to do. And as I say, it's a very good thing to be looking outside of just the four walls of, "Well, here's the question. Let's just do the Maths question, and then you can repeat what we're doing."

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Carly Boreland:
Something that you could do at school is just maybe at lunchtime go to some of the other faculties and just say, "Hey, what are you guys working on right now?" Because no doubt in Home Economics or Technology, they're working on things. They're making things. They're creating things. I think a fascinating place for Mathematics to explore would be Art, and Music is obvious.

Eddie Woo:
Oh, I have to jump in on that one. You just give me such a great segue, because, at Cherrybrook Technology High School, we have a big combined staff room. And for a long time, my section, it's shared a border with Creative and Performing Arts. And the Head Teacher CAPA was a Visual Arts teacher. And one day, I overheard this conversation on the other side of aisle, so I couldn't see what was going on. But I swore to myself, like I was trying to concentrate on writing reports or something. But whatever they were talking about, they were using all these mathematical words, and I was like, "What are they on about?" And I got up, and I went around and had a look. And what they had on the table was that they were going to teach Year 8 about Islamic tiling patterns, which are full of - here are the words I was hearing - symmetry and reflection and tessellation and angles. And I was like, "This is my world, and it has a connection to the Visual Arts that I had never appreciated before."

And one of the big beliefs that I have is that primary teachers have this huge struggle of developing depth in any particular content area because they have to keep themselves broad. But high school teachers have this challenge of we get depth, we understand it, but we often forget that actually, we are not teachers of subjects. We are teachers of students. And so it is incumbent on us to understand what they are learning in all these other areas because we're teaching the same kids. We need to show them the unity and the coherence of the knowledge and skills that they're developing. So I absolutely could not agree more that every time, every opportunity you can get, to learn from your colleagues who have very different knowledge to you. You might not think it's going to go anywhere particularly useful, but be patient because the connections will come up when you least expect it.

Carly Boreland:
This conversation started out talking about why you love Maths, and by the end of it, I was almost hooked too. I think I need to change. I'm not going to be a History teacher anymore. I'm coming over to the dark side. You've enlightened me so much about the wonders and possibilities of Mathematics. I hope there are other people listening, either Maths teachers or potential future Maths teachers, who can see the joy of what you're doing and who understand that mathematics is about so much more than calculating. It's about mastery and success, yes, but of exploration and about thinking of good problems and solving real-life situations that really matter to everybody, but most importantly, really matter to our students. So thank you so much for being here, Eddie and David. And I look forward to hearing more of your ideas about Maths and what we can do together in the future.

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Eddie Woo:
Our pleasure.

David Watson:
Thanks, Carly.

Carly Boreland:
You've been listening to the JPL Podcast for the New South Wales Teachers Federation Centre for Professional Learning. To find out more and to listen to further podcasts, you can visit our website at cpl.asn.au/podcasts.

CONCLUSION:
JPL Podcast is produced by the Centre for Professional Learning and the New South Wales Teachers Federation. All opinions expressed in this podcast are those of the individual speakers and do not necessarily represent the views of their employer or associated organisations. The host was Carly Boreland; technical direction by Jason Nicholas.

Eddie Woo **is Head Teacher Mathematics in the Sydney metropolitan area with experience in public comprehensive and academically selective schools. He is also the creator of Wootube, a platform of over 3000 classroom teaching videos that have been watched more than 3.5 million times by viewers from all over the world. Eddie is known for his innovative and engaging approaches toward teaching and learning the mathematics curriculum, which have been recognised in multiple national awards and gained mainstream media attention. He gained his honours degree in education at the University of Sydney, where he continues to regularly contribute to the initial teacher education program as a mentor to preservice teachers. Eddie is an active member of the Mathematical Association of New South Wales, having been an integral part of its executive committee and being the current lecturer for the Association's annual HSC Lectures on Mathematics (2 Unit).**

David Watson **is a Mathematics Head Teacher in a Sydney High School, experienced in leading teachers from all stages of their careers in syllabus analysis and program development as well as modernizing and engaging the Mathematics classroom. He is a graduate of the University of Technology, Sydney and has worked in a variety of school settings, supporting students from a range of different socioeconomic and cultural backgrounds. Since 2015, David has been a working party member for Lachlan Macquarie College, providing professional learning and networking opportunities for teachers as well as enrichment days for highly engaged students of Mathematics and Science.**