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CPL Podcast: Essentials of Mathematics K-6

Host: Carly Boreland
With: Jenny Williams and Sandra Rowan

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 Teacher Federation's Centre for Professional Learning. I'm Carly Boreland and I'm the editor of the JPL. Today, I'm talking with Sandra Rowan and Jenny Williams about teaching the essentials of mathematics using the New South Wales K-6 Syllabus. Sandra, Jenny, welcome.

Jenny Williams:
Hi Carly.

Sandra Rowan:
Thanks. Hi, Carly.

Carly Boreland:
So Sandra, I want to start by asking you about the particular challenges of teaching mathematics in primary settings, and why some children might find learning mathematics particularly challenging, and what we could do to try to overcome that?

Sandra Rowan:
Okay. So mathematics has got a bit of a bad rap. A lot of kids go, "I'm no good at it. I don't like it. It's too hard," and they've got this perception that only clever kids can do mathematics but, actually, the brain is wired for everybody to do mathematics. So we, as teachers, have this challenge to get kids engaged with mathematics because mathematics is an essential life skill. We need that to be an efficient adult, just to be able to do shopping or figuring out kilometres and buying petrol, all those things that we do every day.

So that's the way we can hook kids into learning, by making connections to the everyday events around them, and explaining to them why mathematics is important. Now, mathematics is an academic subject. You don't normally talk about the denominator and the inverse operations in your everyday conversations at home with your parents, so we do have to teach them with academic rigour, but we need to explain to them where that's going to come up, and why it's important, and we also have to get kids to understand that perseverance is important. So mathematics isn't about doing a worksheet and getting ten out of ten. Mathematics is about thinking, and having a go, and trying strategies. So if this

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strategy didn't work to solve a problem, what else have I got in my toolbox of strategies that might help me come to an answer or a process to find an answer and often they've thought that mathematics is just memorisation. So I learned my times tables, I remember facts about maths, and then I give it back to the teacher, and that's the end of it but it's not really about that anymore. The new syllabus is asking students to be creative and critical problem solvers and that's how we can engage them in the learning.

Jenny Williams:
One of the things that I find interesting about the new Maths syllabus is the importance of understanding, and having an understanding of mathematical concepts, not just procedural knowledge like being able to memorise your times table, and an understanding of what multiplication is. So that idea of having a degree of understanding also impacts on students' enjoyment of the subject. I don't just rote learn maths, I am experimenting, problem solving to gain an understanding of mathematical concepts.

Sandra Rowan:
And in primary schools, it's very important that we give them a range of manipulatives to help them work out the problems using hands-on materials. So if we go outside and identify the angles in the buildings, and a repeating pattern in the brickwork, then they can see why you might need to know about repeating patterns, and why we need to have right angles, so that buildings aren't falling over. So we have to make those connections to the real life, and we have to give them things that they're interested in.

Jenny Williams:
I think that comes back to one of the things that we consider an essential of teaching mathematics and that is knowing your students. And there are two ways in which knowing your students is really critical to teaching of maths: one is that through assessment, we gain an understanding of where student's knowledge is at in mathematics, and that's the building block on which we can place new learning. So that assessment guides our teaching and helps us to see the direction in which to go. But the other thing about knowing your students is looking for and seeking out ways to engage students in mathematics. And, Sandra, some of the things you've said, like different sorts of manipulatives, bringing Lego into the classroom, using film clips and picture books, are great ways to engage students in the study of mathematics, and to show them that it's connected to other things in their lives.

Sandra Rowan:
And the other thing is if we make connections to what's happening within the school, for example, if we're connecting maths to the swimming carnival or the athletics carnival, where they have to measure time and distance, and we say, "Well, this is one of the reasons we're teaching you these things, because we need to know to the decimal point, what your speed was," then they're more likely to be engaged in learning that if there is a purpose that they can see, rather than it's just for pure learning mathematics.

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Jenny Williams:
So one of the other essentials that we outline is looking at the syllabus and understanding the syllabus and really, for every KLA that we're teaching in the primary school, the syllabus is really our starting place. Each syllabus document is set up in the same way and as we gain an understanding of how one syllabus works, then we can use that knowledge to read with understanding other syllabus documents as well. Parts of the Maths syllabus that we particularly want teachers to connect with is what we call the wheel diagram, that they can find in their Maths syllabus on page 32, that shows the structure of the syllabus, and really shows what's at the centre of the syllabus and what's right at the centre of the syllabus is 'Working Mathematically'. We had 'Working Mathematically' in previous syllabus documents, but it's really coming from the cold now, and is central - front and centre - in everything we do when we're teaching Mathematics K-6. The other parts of the syllabus we want teachers to engage with is the actual content and plan the teaching of maths around the content that's in the syllabus.

Carly Boreland:
The first time I saw a K-6 Mathematics syllabus, it's heavy. That's a big book. How important is it to have a copy of the syllabus, not just a downloaded version or an online that you can tap in and tap out of, but to have that whole thing that you can rifle through and how would you engage with that?

Jenny Williams:
I like to have a hard copy of the syllabus. I do use both. But I think as a professional, it's the one document I do need to know well and understand well. At the very least, I should have a download of the stage I'm teaching, but I think to own a copy, $23 bought through BOSTES [now NESA], a tax deduction, is the very least I should do as a professional. And there are times when I find my online version particularly helpful. When I'm programming, I tend to do a cut and paste and put the content into my program, but there were also times when I need to rifle through, make connections between each section of the syllabus. I want to know where the 'Working Mathematically' section is, I want to be able to refer back to the 'Learning Across The Curriculum', I want to find the 'Stage Statements' quickly, and so having the hard copy and carrying that with me, when I'm attending courses or going to staff meetings, I find I really do need to have both.

Sandra Rowan:
So for example, Jenny, we've both have been in this situation, I know, that in certain areas in Sydney, the internet is not great in some schools and so we go in to do a planning day, and they've brought their computers along but there's no internet, or there's been a disruption from building work or whatever, and it's like, "Oh no, we can't plan. We don't have a hard copy," and I'm like, "Well, let's go to the library and find one." But I think there's times where both things are fantastic but, definitely, you need that backup in case you don't have access for whatever reason in your school and the schools I've been in, it happens quite a lot.

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Carly Boreland:
Yeah, I feel the same way. For me, I've have had slightly less experience teaching than perhaps my esteemed colleagues in the booth with me today, but I'm the same, and I like everything to be nice and neat and ordered, but my syllabus is always a bit dog-eared, it's got post-it notes stuck in it. The bits that I use the most are there. And I regularly would pick it up and just rifle through it for the things that I need to know and to check.

Jenny Williams:
I think if we see our priority as being teachers, and that student learning is our focus, not student doing, then really knowing what is in that syllabus for the stage that we're currently teaching is obligatory and I have to say, and this might sound sad, the more I read it, the more excited I get because I can see connections across stages. I can see how learning in one stage links to another stage. I can see how content in one area of Stage Three connects with learning in another part of the Stage Three Maths syllabus and I find that exciting. And if I am passionate about it as the classroom teacher, there's a fair chance I can help my students to feel passionate about it too.

Sandra Rowan:
For example, Jenny, that's so true, in the Early Stage One syllabus, there's a whole lot of dot points about volume and capacity. So you think that makes sense. Kindergarten students are going to be playing with objects, and doing measuring, and all those things. If that is missed out, it is never retaught. So if you go into Year One into the Stage One outcomes, and they haven't had that opportunity to play with volume and capacity and 3D shapes and feel them, they can't visualise later on in life what that container might look like. So when we have the NAPLAN test, and there's a drawing of a container, and they have to figure out what's behind, they can't do it because they actually never played with the blocks or did it when they should have done it. So I think that the foundations are built in Kindergarten. And we must do all that active play and handling equipment and talking about it, so that we can visualise it later on when it becomes more abstract.

Carly Boreland:
And that makes me think again about the syllabus and reading it or viewing it as a whole because if you only ever focus on your stage or your year group without checking in on what's gone before, there are a lot of opportunities there – I imagine saying, "Remember in Kindergarten when –" or "Remember before when –"and to go back to those things, and whilst they might not be revisited as such, there's an assumed knowledge there that's building upon those things. They're connected, and well-designed, and probably, those first 30 or 40 pages are worth spending a bit of time on initially, and then going back to as well.

Sandra Rowan:
In the syllabus also another part that we should look at is the Assessment graphic at the back which has the three types of assessment, and I think the one assessment, as in self-assessment is the new part for

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all of us, and how important that is in terms of learning mathematics that they're self-assessing; they're problem-solving; they're evaluating it; they're thinking about connections. And it starts with Kindergarten, and there's a sample, BOSTES[now NESA], with a tiny little grid with smiley faces; three little smiley faces. And we should be starting in kindergarten with self-assessment. If we start early, then it's just an everyday thing that we're used to doing; it's not a big deal. But that self-assessment as a learner is so crucial.

Jenny Williams:
I think that middle section of Assessment where we look at 'Assessment as Learning', which is the newer aspect to Assessment, and from which we've got dimensions like 'learning intentions', 'success criteria', 'goal-setting', 'providing feedback', that section 'Assessment as Learning' is a reminder of what we know now about how children learn, and about what's going to be the needs of the students in our classrooms now, not just in school, but when they leave school and throughout their adult lives. Thinking about that, making sure that our teaching and programming reflects 'Assessment as Learning', as well as 'Assessment of Learning' and 'Assessment for Learning', is a really important part of being a teacher in this day and age.

Sandra Rowan:
Often teachers want to teach everything at once and so the kids get overwhelmed because their working memory can't hold all that information. So if I'm just teaching one single dot point explicitly, and that's what we want to carry into guided practice, so I'm going to make sure they understand that one thing and guide it and then they do independent activity. So that structure of the lesson is very explicit, like Jenny was saying, and then at the end, we got to allow time for them to have cognitive closure which is where they're thinking about what have they learnt today, and how that relates to other things that they may have learnt previously, and how it connects to the real world. Now, you might also want to reflect on their learning in terms of what did they find tricky. Now, if everything we give them is easy, then there's no new learning. So what we're hoping is that they have a scaffolded struggle. So in the guided, you want to see that they're struggling with the concept a little bit, so that that means they're learning something new. Because if they just go away and do it instantly, that tells you that they haven't learnt a new idea or concept. So we have to have some sort of planning that gives the time down to very small chunks of time in that lesson, so the kids are engaged but it's short and sharp.

Jenny Williams:
I think one of the things you've said has been a real wake up to me, the more I look at the new syllabus, and that is being able to make a distinction between learning and doing. So we really want students to be learning mathematical concepts, and they might be doing that in a variety of ways, not just a hundred maths questions that are – all look very similar with slightly different numbers but engaging with those concepts in situations that are problem solving. So the idea of learning, not just doing, I think is central to this syllabus. I think the other thing for me is unpacking the idea of what mathematical concepts are at the heart of an understanding of mathematics.

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Sandra Rowan:
And so Jenny, I agree with that, because it's quite a meaty syllabus; a dense syllabus with a lot of outcomes to be covered in a short time and the key ideas just focus us on what are the explicit key concepts or key ideas that we want them to learn by the end of the year, and be able to do. And it's a great tool for planning your assessment tasks as well.

Carly Boreland:
So we've talked about knowing the syllabus, we've talked about knowing your students, we have also spent a bit of time on how you can design effective lessons, and then thinking about wanting our students to be problem solvers. What else have we got as essentials, the things that you must focus on first?

Jenny Williams:
Well, teaching vocabulary I think would be the next thing that I would think about. Each page in the syllabus has a section on the language that we want students to be using and we know that if we want students to think in ways that are sophisticated, they need to have a language to express that thinking. So having the technical language of maths is very important. Some of that is identified in the syllabus. On any page where it's outlining a particular outcome, it'll say what vocabulary students are expected to be using, and will highlight in bold any vocabulary that's being introduced as part of this particular sub strand. So thinking about how we efficiently teach vocabulary is really important.

I think often, as adults, some of the mathematical concepts that we have an understanding of, we then find difficult to bring down into simple language for our students. But it is really important that we take the technical language of maths and ensure that our students understand those terms. So in terms of teaching vocabulary, it's the same for maths as it would be for teaching vocabulary in any subject area. We need to identify the term that we're going to start by teaching, we want students to verbalise that word, and then we want to give to students a child-friendly definition, often with a drawing, because it just helps to them to get in their mind a straight picture of our definition, and then we want students to engage with that vocabulary through conversation, through activities, through using the word appropriately in oral context before we might use it in a written context such as their maths learning journal.

Carly Boreland:
And that sounds like a skill that I've heard a lot about when you're trying to teach students writing as well. So you start with maybe the technical language, you break it down into something the students understand, but then you want the students to take that understanding and build it back, so that they can use the technical language themselves. Because kids can get into a bit of trouble, can't they if they only understand something in the context you've explained it to them in, but not necessarily the technical words.

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Sandra Rowan:
For example, if they only know that 'subtraction' is the word 'takeaway'. So they've been taught explicitly that we're going to do 'a takeaway', they don't have any other words for that, 'less than', or anything else. When they come to the NAPLAN which doesn't say 'takeaway', they don't know what to do because they don't know that all these words mean this action and there's a long list of words.

Carly Boreland:
So sometimes our diagnosis or our assessment of what a student knows and can do might be about language rather than about mathematics as such.

Jenny Williams:
And I think teachers can think, "Oh, I'm in a school that's perhaps, say, a high EAL/D population, if I stick to – as in Sandra's example - just using the term 'takeaway', then I'll make it easier for them but what happens in that scenario is they lose the flexibility, because they've got one term whereas really there are many terms they need to be familiar with.

Sandra Rowan:
While we're talking about vocab, there's a huge value in getting students to talk. Valuing the talk in the classroom is really important. If we give kids a problem, and it's a word problem, and they have to look at it and think about the answer themselves, often it's much more difficult for them to do, and especially if it's done in silence. So everybody's thinking quietly but if we ask students the same problem, and say, "Okay. Talk about this at your table," or, "Turn and talk to your partner," then you've got two brains working on that problem. And they're more likely to have an entry point into that problem, by talking it through and saying, "We could try this" or "We could try that," but if we're asking students to do these problems in total silence, it is not the way we learn as a learner. We need to be able to talk it through and think it through first.

Jenny Williams:
The value of that talk I think too, Sandra, is that, as we share our thinking processes, our thinking partner, or the others at the table are seeing perhaps other ways of working something out; a different strategy they may not have thought of or tried. And so they're learning from their peers that there are different ways to attack problem-solving in maths. When I think about the value of talking to learn, I also think about what teachers need to do in the way they structure their lessons. Their talk does need to be a component, and Sandra, you mentioned before the importance of having a time of closure where you reflect at the end of the lesson on what was learnt, what you might do differently, and what students are taking away in terms of their mathematical understanding. The other aspect I think is the type of questions that teachers ask, and if we're only ever asking questions that require a 'yes' or 'no' answer, then we're really not stretching students to think about their learning and challenge them. We need to be asking questions that are worth answering, and then we need to be giving students 'wait

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time', so that we are saying to them this is a question that's worth thinking about before you give me an answer.

Carly Boreland:
Jenny, would you mind indulging us by giving us an example of a kind of question like that, and how long you wait, how it feels to wait for the time that a student needs to think? Because I think that's very hard for a teacher to let that space happen.

Jenny Williams:
I think all teachers are challenged about wait time, that if the silence – the teacher rushes to fill that silence - but we say five seconds, and if you count off five seconds in your classroom between you asking the question and then asking a child to respond, it's a considerable length of time. But it does show that we are expecting that students will switch on their brains, and think about what's being asked, and I think that validates that thinking is an important part of mathematics, and so that we're saying we value that. And if I then ask a child, and they can't give me an answer straight away, I want to be able to say to them, "I'll come back to you, so that you have plenty of time to think about it," not brush them aside and move on to someone else. It's important that we understand that thinking is important and takes time.

Sandra Rowan:
We talked about questioning. There's three types that we talked about: 'effective', which is promoting critical thinking and reflecting on learning and deepening their conceptual understanding; then there's 'reflective' - what would you do differently next time, what strategy did you use, was it successful; and then 'connecting - so what ideas have we learned today that'll be useful when solving similar problems like this, and what does this remind you of in terms of the mathematical ideas it might be, something we've learned previously, or a connection that they can make of other KLAs, where we might have used the timeline in History, it's very similar to what we're doing here today.

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Carly Boreland:
Something that comes up a bit in Mathematics in primary and I think high school as well, is the question of differentiation, which I think is equally well understood as catering for the needs of the students in your class and how you do that. And I know that there's often a range of ways that you can do that, so that you can stay sane, and that you can actually teach your class and teach your lessons and be feel organised for that, and still have a weekend. Could you help us a little bit with Maths particularly, and how to do those things?

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Sandra Rowan:
So all students in the class are entitled to be exposed to the stage appropriate outcomes that happens in the explicit teaching part. Then when we're differentiating, that, because we might feel that student is not quite up to that, they haven't got the maths that comes before that, how can we help them? So the one way to do it is to have open-ended problems where the students for example could choose two-digit numbers to do the same problem, but in the syllabus, they're supposed to be using up to five digits. So if you give them choice and say, "Choose some numbers. Show me how to do this in an open-ended problem," that would be one way.

Another way is to put the kids in mixed ability groups because the students that are often struggling, or are not sure, can listen to the more able students explain their thinking and sometimes show them how they've done it - if it was a problem. And the students are learning again from other students, which they do actually value, how they might enter that problem, and what strategies they might use. And, they may not have that in their toolbox yet, but by listening to others. So it's quite important that they're exposed to other students in the class, not set into one group of all the kids who are struggling and here's all the group that are 'working beyond'. It's not like that. It needs to be a mixture, because they learn from each other. And there are times where you might want to pull that group that's struggling onto the floor for five minutes and say, "Right. We need to look at this basic point." And we do it on the whiteboards, we have a chat about it, so we're making sure; you're checking in that they've got that concept. Then they go back to the groups to do open-ended tasks with everybody else. And [we do] the same with the ones who are 'working beyond'. So if you get them to pose their own problems, which is what the syllabus says to do, the ones who are 'working beyond' will stretch themselves. They just do it automatically. You don't have to say, "I want you to stretch yourself and give me something clever." They just do it. So you can get everybody creating their own problem from the most simple problem to a very sophisticated problem, and they need to hear it all within that classroom, and it should be your class you're teaching Maths to.

Carly Boreland:
So the time and energy goes into checking in on those groups and seeing how it's going, and having those conversations with the students rather than spending your time at home constructing the same groups or composing the same worksheets for a particular group or something like that.

Sandra Rowan:
So if you look at the research from Carol Tomlinson who's the guru on differentiation, she doesn't say have five different groups of each doing a different problem. She talks about compacting it and making it – for the bright ones, maybe they do a small part of it, and then they create their own. She's got strategies there. But the kids do not need five – you don't need to create five different activities for each group. You need to be aware of who's working where - and that's the assessment that you have at your fingertips to know which kids need help - and then you're giving them the syllabus outcomes and content points, which is that they're entitled to, but you are differentiating in different ways, not the

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content, but with support, with manipulatives, maybe using a calculator, things like that, that would get them to that answer but not learning the stage previous.

Jenny Williams:
I think one of the key things there is that what for a teacher to hold in their head -what is the mathematical understanding, or concept, that I want students to take away from this? And it's often possible to get that mathematical understanding, or concept understanding, while dealing with simpler procedural array of numbers or tasks. So holding in your head what it is, in terms of the understanding, is particularly important. I think something that really helps teachers here too, is an understanding of what are the most common misconceptions. If we discuss with teachers who have been teaching maths for a while, the list is always the same, of the sorts of things that students find tricky or have misconceptions about.

Sandra Rowan:
An example of that is that the denominator, if it's 1/36, that's a bigger number than 1/2, which is a half. So they think the bottom number getting bigger means the number's bigger because when we count that's what happens. And the other one that came up is 'place value'. So if you haven't got that decimal point in the right place, or the understanding of the tens and the hundreds, then that's going to stop you getting a correct answer, because you're not putting the numbers in the right place.

Carly Boreland:
And more than a correct answer, both of those misconceptions, or misunderstandings, have real-life implications, don't they? It's not about, "Oh gee, I won't be able to do the test well now." That impacts your ability to do a range of things, including just the groceries.

Sandra Rowan:
Exactly. And we talked about medicine. If as an adult you have to take medicine, there's a big difference between five mils and 50 mils. Dire consequences if you give your child the wrong amount of medicine. And it's the same as what you're talking about, if in real life, you want to order a metre of tiles but you order ten metres, well then you're stuck with them, aren't you?

Jenny Williams:
So I think it's interesting, Carly, you asked us the question about differentiation, but connected to that, for a teacher, I think, is having an understanding of possible misconceptions as they start their teaching sequence, because if you can correct, fix up a student's misconceptions, then you're opening up their understanding and their level of understanding, and that's going to make a difference to the kinds of tasks they can access in a variety of different situations in maths.

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Sandra Rowan:
And I think it's also a positive, because we can say to students, "I think this is a misconception here." So you might have been away the day that was taught, or you've misunderstood it. So it's not about you got that wrong. So once we start to say to them it's okay to have a misconception, -"I used to think and now I think " - and so you can get a much better reaction to your instruction if they start using that language of, "Oh, that's a misconception."

Carly Boreland:
Sandra and Jenny, thank you.

Jenny Williams:
Thank you.

Sandra Rowan:
Thanks Carly.

Carly Boreland:
You've been listening to the JPL podcast for the Teachers Federation Centre for Professional Learning. I'm Carly Boreland, and I'm the editor of the JPL. I've been speaking with Sandra Rowan and Jenny Williams from Trio Professional Learning. And if you'd like to find out more about our podcasts or to listen to further podcast, you can go to our website at cpl.asn.au/podcasts

CONCLUSION:
The 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.

Sandra Rowan **was previously a Deputy Principal in an inner west Sydney school. She is an experienced K-6 classroom teacher and school leader. She has been a literacy consultant in western Sydney and a teacher mentor working with beginning teachers to develop best practice. She spent four years working in New York schools as a maths and literacy consultant. In New York she supported schools as they prepared for school reviews.**

Sandra has published eight teacher resource books that provide explicit units of work across the key learning areas. She provides teacher professional learning at a school level as well as having presented at conferences on literacy and maths.

Jenny Williams **has extensive teaching experience including secondary English and primary K-6. In addition she has worked as a support teacher learning difficulties. Her enthusiasm for early literacy and**

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working with students whose literacy is at risk led her to train as a Reading Recovery teacher and subsequently work as a Reading Recovery tutor.

As an educational consultant she has worked in Western Sydney and New York supporting teachers as they developed their literacy practice, quality teaching pedagogy and mathematics instruction. She has supported whole school improvement in a number of schools in Australia and overseas, working with school executive teams and school staff to invigorate teaching practice leading to whole school change.

In recent years she has presented at several literacy conferences and co-authored literacy-teaching resources.