

**Podcast: Good Enough Homeschooling**

**Episode: 13: Teaching Math in the Homeschool Part 1**

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**Transcription by Keffy**

Courtney: [00:00:00] Welcome listeners to the Good Enough Homeschool podcast where we cheerfully eviscerate popular homeschool curricula. In today's show we have a special guest Lu Allen of Epic Education Illawarra is joining us from Australia to talk about mathematics in the home school.

[00:00:15] This is the first of two episodes of our conversation.

AJ: [00:00:18] Lu, hello!

Lu: [00:00:20] Hi there. I'm calling in from a regional city called Wollongong, which is just south of Sydney. First of all, I'd like to acknowledge the traditional custodians of the land here. I'm on D'harawal country and I'd like to pay my respects to the elders past, present and emerging.

[00:00:34] I'm homeschooling my 11-year-old I've always homeschooled him, he wasn't really school ready at school age. And there were also a lot where he was quite advanced in a few domains. And so we started reading stories to each other and playing lots of games and he was just learning so much that we just kept at it really.

[00:00:50] So we were living a bit further down the coast. And then I started university a few years ago. We moved up to the city Wollongong, here, so I could be closer to the uni. Got started studying, myself, found that I was really enjoying my study of mathematics. I was really enjoying homeschooling my son, we were learning lots of mythology and having lots of fun with that. So I started offering classes to local homeschoolers. And that's just kind of built up over the last few years. I'm teaching lots of different subjects at lots of different levels now and having a really good time with it.

AJ: [00:01:19] That's really wonderful. How did you come to to be studying mathematics? Was that something that you enjoyed in school?

Lu: [00:01:25] No, I didn't really have any particular talent for mathematics at school. I was interested in science and I found that I was going to need to study more mathematics in order to study more physics. So that was kind

of my motivation back then. I didn't finish high school. I had some really complex health challenges as a young person. I spent a lot of time in hospital through my adolescence. In the end, I decided not to complete high school and that if I wanted to revisit education later, it would be as a mature age student. I jumped into an undergraduate course in maths, basically, because I wanted to try university and I didn't want to rack up a student debt for something that I could have read out of a book, or taught myself, like, well, what's the most difficult thing that I could take that I would never be able to teach myself. And I picked maths, and I did get into the degree.

[00:02:13] And the first year was extremely challenging. I was doing sort of first year calculus at uni without having done the prerequisite subjects at high school. And I loved it. I loved the challenge. And so I stuck with it. Instead of wanting to learn maths in order to learn more science, now, I just am learning maths to learn more maths, basically,

AJ: [00:02:29] That's really wonderful. Hats off to university administrators who are willing to give nontraditional students a chance. And I think it's also good for homeschooling parents to be aware that some of those options are out there, not only for themselves, but also for their children who might take a nontraditional path through education.

[00:02:45] So Lu, you mentioned that you and your son really enjoy mythology and that's something that you teach in your online classes. So how do you see mathematics fitting into classical education?

Lu: [00:02:58] I think currently, in general, it isn't fitting in very well with what many classical educators are doing or are wanting for their students. Mathematics in a classical education... we are not teaching mathematics classically, like we're just not. I think that formal logic is underrated. I don't understand why so many people are so happy to do informal logic and then formal logic is just kind of this other thing out there that is... I don't know people if think it's not going to be useful, or if it's just not necessary. And they feel it's a bit too, it's maybe a specific skill set that they don't value.

Courtney: [00:03:38] I think a lot of people just don't know, it exists.

Lu: [00:03:40] Yeah, there's that as well.

AJ: [00:03:40] And I think that people that do are intimidated by it. Particularly if you look at the textbooks that are out there, right?

Lu: [00:03:45] It can be very dense.

[00:03:48] As classical educators generally, we probably would tend towards teaching subjects so that our students can connect with, say, an intellectual heritage. More and more, I can see people challenging this glorification of empire and Western civilization. But we still need to acknowledge that this tradition has its roots in the classical world.

[00:04:06] I think we should be talking about mathematics, as it did exist in the classical world. And its development, sort of through the Renaissance. And after being either utilitarian for building and accounting, or abstract for geometry, we did end up sort of through the Renaissance and the Enlightenment, folding it into our studies of science as well.

[00:04:28] I don't think that most students, not even classical students, really understand where our mathematical ideas have come from, and why they were developed, for what purposes and at what times. So I do think that some history of mathematics would be really important if you have a goal to be teaching it classically.

Courtney: [00:04:47] So right, Lu. And you know, it's interesting that you say that, because I'm gearing up to teach astronomy for the middle school level next semester.

Lu: [00:04:54] Yeah.

Courtney: [00:04:55] And we spend a week on the history of astronomy and astronomers through the ages. And one of the things that we talk about, very briefly, we dip into how astronomy moved from a static field, you know, tables of numbers and such like, through Isaac Newton's calculus, which he developed in pursuit of astronomy. A lot of people don't realize that, that he developed in pursuit of astronomy, and how that changed the way that people thought about the relationship between the Earth and space.

[00:05:29] And I think it's so fascinating. And Kepler wrote his equations in the form of music, I show them the sheet music.

Lu: [00:05:37] Yep.

AJ: [00:05:38] Delightful.

Courtney: [00:05:39] And I agree, Lu. If people knew about this, thought about it, I think they would be really into it, but I don't see much knowledge of it out there.

Lu: [00:05:50] What is out there, it can be really inaccessible as well.

Courtney: [00:05:53] Mm hmm.

Lu: [00:05:53] So we've got these ideas, and we have our primary sources. But we don't really have a bridge from those primary sources to an accessible lesson.

AJ: [00:06:03] You know, the example, Courtney, that you just brought up is, is really a perfect one for how the pieces of the quadrivium fit together. And we talk about the trivium all the time in classical education, but the quadrivium is often set aside, or we say, well, that was an old-fashioned way of what we now call STEM. That's not really the way it works, so.

Lu: [00:06:23] I do feel that there's a bit of sort of the classical educating communities that I'm a part of, there is a bit of like, well, we educate classically, but not like that weird, obscure away with the Greek and the astronomy.

AJ: [00:06:35] Mm hmm.

Courtney: [00:06:36] Lu, I will say that for a long time, I couldn't find the connections. As far as I know, there isn't a curriculum that does a good job blending that in. There should be, but there isn't somebody get on writing that please, if you're listening.

Lu: [00:06:54] Yeah, I agree. I haven't seen anything that does it.

AJ: [00:06:57] There was that one curriculum that you shared with me, Lu, a while back, that went back to actual Greek sources.

Lu: [00:07:03] So we do have a program. I think the publishers name is Polymath Classical. It's sort of a study guide to working with Euclid, and with Nicomachus. Euclid for geometry, and Nicomachus basically for arithmetic and number theory. It's really fun. It's not perfect, and it doesn't have everything.

[00:07:23] One thing that I would include, if I were to sort of design a mathematics curriculum for classical students, is that we would definitely be starting with logic first. I don't know how many people know that Aristotle wrote these laws of thought. There are only three of them. And they're basically the laws of logic. So Aristotle's laws of thoughts give us three different axioms that we can use to construct different arguments. The first is the law of contradiction. It's that P and not P cannot both be true at the same time.

Courtney: [00:07:56] Okay.

Lu: [00:07:57] Pretty straightforward. And I think most people understand that. There's no trick to it. That's exactly what the law is, and what it states. There's the law of the excluded middle, which is that either P is true, or not P is true. There are no other options.

[00:08:11] The third one is that a thing is identical with itself. This one at first glance seems sort of like there's not much use for it. It basically says X equals X, or A equals A, or P equals P. But this law of identity becomes important later, mathematically. Aristotle had the foresight to include it in his three laws of thought.

[00:08:30] And then this was picked up by a mathematician called George Boole about halfway through the 19th century, and he constructed an algebra using these axioms that became known as Boolean algebra. And Boolean algebra is actually the mathematics of electrical circuits and logic gates. As you can probably imagine, the applications are extremely far reaching, and extremely relevant to people today.

[00:08:54] If you have kids who play Minecraft, that's what redstone is all about.

Courtney: [00:08:58] Is that the same sort of Boolean logic that you do this AND that in search engines?

Lu: [00:09:04] Yep, you can have this AND that, this OR that, this OR that as in either one or the other, but not both. Those are all sort of functions of Boolean algebra.

Courtney: [00:09:14] And how much influence does that sort of thing have in our day to day lives with search engines, right?

Lu: [00:09:20] Oh, it's huge. Yeah.

Jenn: [00:09:21] That's the internet. There's a huge section of that in that Joy Hakim science book, the second one in the series.

AJ: [00:09:29] That's good to know.

Jenn: [00:09:29] So if you're doing Build Your Library 8, your kids will study that.

AJ: [00:09:34] Why was I not taught this? And there's no reason that we couldn't, in fact, teach this to students before university level.

Courtney: [00:09:39] Keith Devlin wrote a really good book called The Math Gene: How mathematical thinking evolved and why numbers are like gossip. If

you're thinking about trying to figure out how kids get to be mathy or not mathy, I highly recommend it. Although I would prefer Stanislas Dehaene's *The Number Sense*. I'd much prefer. But they're both really good.

Lu: [00:10:05] Basically, I would strongly encourage anybody wanting to explore mathematics classically to go straight to Aristotle and then follow up with George Boole. Part of why I'm making these recommendations is that, personally, for all that I love logic and the thrill of an elegantly constructed argument built upon these foundations, I don't think this is really how most humans think or communicate. And that mostly we learn from stories and songs. And I think it's really important to acknowledge when we're communicating with each other, whether it's built on a foundation of axioms, or on a foundation of values, or shared beliefs, we are not identifying whether we are speaking from a particular ethical framework or a particular list of educational objectives. The waters get muddied really, really easily. And I think that if, as younger people, we had practice identifying, hey, do we share these axioms? Can we build an argument on them together? Or what are our values? Whether we need to state our values up front to check that sort of, we're on the same page. Learning logic helps us do this. Even if we learn logic, in order to learn to communicate more empathically? Or sympathetically, I think that that's a good thing as well.

Courtney: [00:11:25] And now I want to run out buy a logic book.

AJ: [00:11:27] What would you recommend, Lu?

Lu: [00:11:28] My work here is done.

Jenn: [00:11:31] But Lu, now you've got to give us what do we buy to learn logic?

AJ: [00:11:35] Just the fact, Lu, that you looked at this from the point of view of we have these axioms, what can we build together? I think part of the problem is that for many people, both within university systems and outside, we see logic in our culture as a way to win. We see it as a way of winning arguments, it's not about working collaboratively to find truth,. It's about demolishing the other person. That is part of the heritage of the Greeks, but it's not the whole heritage of the Greeks. And it's certainly not our global heritage in any way.

[00:12:10] So it really is one of the things that struck me about this class that I'm doing with Professor Devlin is that he talks over and over again about how important it is to work together with your other students. Get

in study groups, get on a forum and talk these things through. And when you and I have spoken previously, you've talked about that in your university studies that you have study groups with people and you talk through these ideas with your peers and with your teachers. And that that is how you learn.

[00:12:38] One of the things that I have certainly seen in classical materials. Specifically, the ones coming from certain Christian classical publishers, is an sometimes very overt argument being made that you need to learn these skills, because it will allow you to either defeat the heretics or convert the heathen. Logic has to be in service to theology.

Courtney: [00:13:01] I have seen that. We learn it so that we can use it in the purpose of the hamster on the wheel spinning higher in our academic achievement, so that we can get into the right middle school so that we can get into the competitive high school so that we can get into the Ivy League school so that we can get into the right law school so that we can get into the right internship.

AJ: [00:13:24] So the next question I had was that, as a tutor, you of course, are dealing with students at all different levels and with all different needs. What are some of the common struggles you see as a tutor in mathematics, specifically? How do you go about helping your students with those struggles? And also, I think we should bring up the big question of math anxiety, which of course many people identify with.

Lu: [00:13:46] Yeah, there's a strong link between seeking a tutor and having maths anxiety. Very, very strong correlation there. People usually get in touch with me and ask if I can tutor mathematics at a particular level and I don't always say yes right away, I usually ask why their family is seeking a tutor and it usually is due to parental anxiety about maths, I teach mostly homeschooled students. I do have a few students who are in school, and either need help catching up or need extension, because that's not being provided for them in their classrooms. But yeah, most commonly, I'll say, why are you seeking support with this? What's going on that makes you think that you need a tutor for your student, and it's usually that the family, the home educating parent and the child have just not really done any mathematics for a really long time. The parent is starting to get anxious about that and the possible sort of outcomes for their child and whether the child is going to fall behind how they can get back on track. And generally, they want to outsource it to me completely, which isn't really practical for younger students who really should be doing a little bit almost every day, I would say. I mean, I know some people school seven days a week, some people it's four, which is quite a

difference, but you would be wanting to have direct instruction several times a week for a younger student. It's not really practical for me to be providing that.

[00:15:08] Generally we talk about what program were they using before, if any, why it became difficult to implement? Sometimes it's because people skipped things that they didn't understand. That's a really common one, both with home educating parents and all students. So I've had homeschooling parents say to me, well, I didn't understand that part of the book so we just skipped it. That, as you might imagine, becomes extremely problematic later. But I've also had students who have been working at school with not very close oversight. One student in particular, takes amazing notes. I asked to see their workbook exercise, but when you're taking notes in class, show me what you're writing down. And they brought me their book, and I had a look over it. And they're extremely comprehensive notes highlighted in all the right places. And then there were the exercises, the rest of the page, was blank. And then two pages later, there's another set of notes taken from class, and another two blank pages. And the student didn't know how to do any of the work, didn't tell anyone that they didn't know how to do any of the work, and simply skipped all the questions they couldn't do, which turned out to be the entire chapter. So they did very poorly in the in the test at the end of that topic. But the assessments at school are not actually used to improve the teaching and improve the student's learning. They teach them the things. The students either do their homework, or they don't they test the students, they get either very high or very low scores, generally. And then they move on to the next topic. So it's like, oh, well, you didn't really understand much of that, did you? But that's okay. We're doing geometry next.

Courtney: [00:16:38] Yeah. I see that all the time, Lu. Actually, it's a middle school level, and I think it's a developmental stage. They get confused. They're expected to be working independently. They can't do it. They're ashamed. They don't tell anybody. They'll show up to class. They'll take notes. They'll do good stuff. They'll be obedient and quiet and cooperative and smile, and they just don't turn stuff in. And then the parents get like a bad report. And yeah, like, hey, what's the matter? And then it snowballs, like, it's been a month or six weeks, and they're that far behind. See it all the time.

Lu: [00:17:09] That's one of the really big challenges, both anxious parents and anxious students, is skipping what you don't understand. Sometimes it's because the program simply hasn't provided enough support to an anxious, not very confident parent. We don't have great options for

homeschool curricula here in Australia. It's pretty hard to get ahold of things that are published in the US because of our exchange rate and because of the shipping. We don't really have that many opportunities to look through samples of things.

[00:17:37] I've been speaking with a lot of new homeschooling families recently. With the pandemic, a lot of people ended up with their kids at home, found that the kids were learning so much better at home anyway, and deciding to register for home school. They're new and they've got lots of questions. I'm like, look, if you are going to drop money on curriculum, do it for mathematics and do it for writing, because those, in my experience, are the two big things that anxious parents really struggle to teach.

[00:18:03] And I do think that, at least here in Australia, using a homeschool curriculum is highly underrated. And they talk about well, there's a lot of mathematics in building a veggie patch. Your student will have to measure the dimensions of the veggie patch and multiply to get the area and the volume and work out how much dirt to put in there. I'm like, okay, that is, you know, one example of one equation. I'm not quite sure how far that's going to go in a child's mathematics education.

[00:18:27] Because it's hard for us to access homeschool specific curricula, a lot of people are using exercise books, not exercise books, but books full of exercises that they find at news agents and, and toy stores and things like that. People are using these books. They're not really understanding what's in them. The books ask all sorts of different questions. They're big, big mixed up of different questions from different topics and subtopics of mathematics. The students can do some of them, and then they skip the bits that they can't do. And then the parent says to me, well, they weren't able to do these bits, but not the others. And I don't know how to teach it. And I'm like, well, that's because this isn't a curriculum that teaches mathematics. This is a test prep booklet. We have standardized tests here in grades 3, 5, 7, and 9 called NAPLAN. And they're a very big deal in the school system, not so much for us homeschoolers. But there are a lot of publications out to help people improve their NAPLAN scores. Unsuspecting homeschoolers are trying to use these books as a curriculum to teach maths. And that's just not what they're designed for.

[00:19:27] Often, when people contact me and say, we need a maths tutor, there are other things they could be trying rather than paying me they just have been really poorly supported by bad advice, publications that are not actually designed to teach, they're just designed for practice.

Courtney: [00:19:43] I very often have difficulty conveying the difference between a practice book and an actual curriculum that teaches things to people. They do not understand the difference and there is a difference, right Jenn?

Jenn: [00:19:57] Oh, definitely. Especially for Parents that aren't confident, you need a scripted curriculum. Or at the very least you need something where each concept builds on the next and give you as the teacher examples before you hand the book off to your kid. Those workbooks that you would find, like Lu said, at Barnes and Noble or even Target, that's to review something that your child has already been taught. It's not the same thing at all.

AJ: [00:20:27] I wonder sometimes if because of our experiences in the schools here, where your only exposure to math might have been the workbook that was handed to you as a student, that you don't really realize that there's a whole other side to it that involves instruction, and particularly those of us who were sort of experimented on. In my elementary and middle school education that was right in the midst of major changes in how mathematics was being taught in the public schools. Because I went to school in a state that had good schools, lots of money, progressive, and all of that, they were very quick to jump on the bandwagon when it came to new ideas, whether or not those ideas were actually very well tested. So we ended up being guinea pigs. I went through a whole stretch where there was no actual direct instruction. We were given worksheets that were supposed to be directed to the student, and you just did the worksheets until you were done with the worksheets, and then you moved on to the next set of worksheets whether or not you actually understood anything.

Lu: [00:21:26] It seems to me to be a really terrible waste of actually having a person there with teaching skills. [Crosstalk] learning is relational.

AJ: [00:21:33] They wanted kids to master the ideas. But because kids would do that at very, very different rates for mathematics, the idea was that this was a self-paced curriculum, and that they basically couldn't move forward until they had mastered something. But in practice, that's not the way it worked.

Courtney: [00:21:48] One of the things I realized the longer I've been teaching is how utterly absolutely, fundamentally critical K-4, so this would be for Australian listeners, this would be ages 5 to 10 or 5 to 12, somewhere around there, that traditional arithmetic education is in building later conceptual understanding. And I think what happens is a lot of those early elementary teachers don't feel confident in math, they don't like

math, they don't understand math, they end up giving really bad explanations, just teaching students how to do the thing and then moving on. Or rigidly adhering to a curriculum that they don't fully understand. And so what you have, then, especially with curricula where you do a chapter on fractions, and then you don't see it again for another year, is students have huge gaps and immense gaping voids in the conceptual understanding of how math works.

[00:22:50] I think that what happens for homeschoolers a lot, and a lot of us are high achieving kind of people, we tend to be like, oh, three plus three, aha, ha ha, that's so funny. It's so easy, kid. Here, we'll just zoom through all of this. And as long as you can memorize your addition tables and your multiplication tables, we're good to go.

AJ: [00:23:09] And this actually brings up a question that that I wanted to ask you, Lu, and this sort of relates to this idea that children and people generally are either mathy or not mathy. They find math ideas easy to take in, or they are really good at calculation, or they are great calculation, maybe not so great, but they're fantastic at the conceptual stuff. Or they're just high achieving in math class, whether or not they understand mathematics, if that makes sense.

Lu: [00:23:36] So the mathy, not mathy question. When I look at other students, or people in academics in mathematics, and people who have done well and have got good marks and are doing well in their career, often, the first thing that people will think is that they're really smart, and probably that they're really good at mathematics.

[00:23:53] Generally, I look at academic success and I think to myself, you have had a very favorable support versus barriers ratio in your life. And I think that that is not just true of adults in an academic setting. I think it's true of children in academic settings as well. I think the students who are doing well are students who are having their needs met, whether those needs relate to the actual subject matter or not. Students who have their needs met in an educational setting will do well, they will learn what you put in front of them one way or the other, you might need to make some adjustments. But generally, if the student's needs are being met, they can learn any things age appropriate that you put in front of them. And sometimes those needs include being challenged. And sometimes those needs include backing up and saying to an anxious student, you need to tell me if you start to panic so that we can stop because we do not want your little brain associating mathematics with panicking. That's the worst possible thing that we could have going on. So you need to let me know if

you're starting to feel anxious, and we will put the lesson away, we will walk away from it.

[00:25:05] I don't know if there's any evidence out there about people being mathy or not mathy. But when I see students struggling, it's because there are unmet needs elsewhere. And when I see students doing well, it means that they have support in the domains that they need it in order to be successful academically.

Jenn: [00:25:25] When people are just starting to homeschool, there's so much more to it than just the curriculum. So yes, a lot of people are obsessed with what do I buy? What do I get? What do we do every day? What should my schedule be? But so much of it is really in your family relationships. And that is such a good point, especially when people say, oh, my kids won't listen to me, how am I going to get them to learn for me? And they... that's where, although I'm not an unschooler, I really do see that there could be some value in taking the first month or so at home just to get in routines of mutual respect. This is how it's all going to work and, and even having fun with your kids. They see each other at night and on the weekend. And that's just a very different dynamic than everyone being home together all day every day, like it is now.

Lu: [00:26:20] And also if kids are coming home from school, they're tired from being at school all day. And yeah, the parents are tired too. And everybody's tired, and you've only got a few hours until bedtime, and everyone's counting down.

Courtney: [00:26:30] If you don't have that underlying foundation, then it's going to be miserable for you, and it's going to be miserable for them.

Lu: [00:26:37] That's a great recipe for just not doing any math at all really.

Jenn: [00:26:41] Well, and you think about how many kids have had terrible anxiety all through their school career, and then they get home. It goes either way. Either things turn around, and that's where you get people saying, you know, my kids are never going back to school. They're really learning. They're catching up. Because kids will, they'll take leaps and bounds once they're ready to go.

Lu: [00:27:01] I don't want to sound like I'm saying parents of schooled children do not have quality relationships with their children.

Jenn: [00:27:07] No, I don't either.

Lu: [00:27:09] That's not true and...

Courtney: [00:27:09] It 's a different kind of relationship.

Lu: [00:27:12] It's very different. A lot of it's about managing the schedule that comes with being at school. We can't stay up and watch this movie together because you've got to be up at a certain time in the morning to get on the bus. This schedule sort of imposed on you and on your entire family, the lack of flexibility makes it really hard to be spontaneous and do a fun thing when everyone's in the mood for it.

[00:27:32] I'm sympathetic that people are missing out on that and then jump into homeschool and find themselves with a lot of time, but no experience of filling that time in a relaxed way or in a way that meets the needs of several people at once, which can be a really great bonding opportunity.

Courtney: [00:27:48] Or in a productive way that isn't anxiety-driven about the time ending.

[00:27:53] This is the end of episode one. Join us next week for the second of our two part series on math in the home school.

[00:28:01] Thanks for listening to Good Enough Homeschoolers. Before we go, show some love for your new favorite podcast by leaving us a review and stay tuned for next week where we finish our conversation with Lu.