Hello, thank you for downloading this podcast from Teacher magazine – I’m Jo Earp.

The demand for graduates armed with STEM-related qualifications (that’s Science, Technology, Engineering and Maths) is forecast to grow here in Australia, but in schools student participation rates (nationally at least) in advanced maths and science subjects is declining. I’m here today with Michael Jennings, an Associate Lecturer at the University of Queensland. His current research – with Professor Merrilyn Goos and Professor Peter Adams – explores factors influencing student selection of senior secondary maths subjects.

Jo Earp: Michael, welcome to The Research Files. This study looks at the situation in Queensland doesn’t it – and before we go into the results, I mentioned in the intro there about national participation rates, but what’s happening at a state level?

Michael Jennings: Hi Jo, thanks for having me today. The numbers at state level have been quite interesting. Overall, the numbers since the early- to mid-90s in Advanced Maths have dropped, but when you look at each individual state (and specifically I looked Queensland, New South Wales and Victoria), it does vary from state to state.

In Queensland, we have had a big increase – 20 per cent in both males and females in Advanced Mathematics since 2008 – and that’s largely on the back of the bonus point system that a lot of the universities introduced. And so we’ve seen a huge increase in comparison to other states, where there’s been a big decrease in New South Wales, not just in their Advanced Maths but also in their Intermediate Maths, and to a lesser extent in Victoria.

JE: Just to pick you up on that Queensland stat, could that be as a result of just increased student numbers?
MJ: The numbers of students staying until the end of Grade 12 has certainly increased, but the Maths C raw numbers have increased 20 per cent. What we find in Queensland is that only about 52 per cent of students actually receive a university entrance score (ATAR as it is commonly known, OP in Queensland). Only 52 per cent of students in Queensland actually get that uni entrance score and so when we have a look at the Advanced Maths numbers, it’s actually up to 15 per cent now of students who get a university entrance score are choosing Advanced Maths.

JE: But there’s something different going on in Queensland … and that’s where your research is exploring really. What was the aim of it, is this an ongoing study?

MJ: It is, I was a high school maths and Japanese teacher for 10 years and I’ve been at UQ for the last 12. I guess I always wondered – at high school and since I’ve been at uni – why students choose the maths subjects they do in senior and also how they go once they’ve left school and come to university; I’ve been on both sides of that transition fence, and that led me into the research topic for my PhD. …

… So, across Queensland I had 1000 students, spread from Cairns to Coolangatta, Mount Isa to Mackay, representative of the three educational sectors (state, independent and Catholic), also representative of the location of the school, not just along the eastern seaboard but out in the bush as well. About two thirds of those [students] had just chosen Intermediate Maths and I asked them why they didn’t choose Advanced Maths and did someone influence their decision; then I had about 300 or so students who chose both Advanced Maths and Intermediate Maths and I asked them the same questions.

JE: So, you basically wanted to explore why they did or didn’t choose maths. You also spoke to teachers about that and university lecturers as well … how many teachers were involved?

MJ: I had 60 teachers and 20 mathematicians from across the unis. It was a follow-on essentially from the ‘Maths? Why Not?’ project from the mid-2000s that asked teachers and guidance counsellors why they thought students weren’t choosing higher level maths. They didn’t have any access to students, so I’ve gone straight to the students, but also included the teachers and the university academics.

JE: So, let’s look at some of the results now then. Firstly, why they are choosing maths – and this is from the student perspective – what were some of the things that you found there?

MJ: They’re choosing both Intermediate and Advanced Maths … two out of six
subjects, seven if they go to a religious school. I guess, unsurprisingly, the students liked maths in junior, they were good at it, they thought they’d do well. They realised that they needed it for university, technically they don’t because Advanced Maths isn’t a [prerequisite] for anything in Queensland, and I think it’s only a [prerequisite] for one degree perhaps in South Australia. So, while it wasn’t a strict prerequisite to get into university the students saw that it would be benefit to them, having that extra two years mathematical thinking for their future study.

There was influence from parents and maths teachers, to say ‘go and do Advanced Maths’ and so that was interesting, particularly when we have a look at the reasons why students didn’t choose Advanced Maths along with Intermediate Maths. Some other main reasons were: they thought it would help their university entrance score; and, interestingly, they said it would be good for their life. That was a question that I took from the Maths? Why Not? project … and the Advanced Maths students agreed that said yes that was one of the main reasons why they were choosing Advanced Maths – it would be good for their life. Now, whether that meant just in terms that it would make life easier at university, or it would give them a broader thinking base, I didn’t delve into that unfortunately with interviews.

JE: Then, on the flip side of that, the reasons why students are not choosing to continue with it. There were some interesting things there as well, and you mentioned about benefiting their life. That, actually on the flip side was a reason why some of them didn’t go down that path wasn’t it?

MJ: It was, that was one of the main reasons. There are probably six top reasons why they didn’t choose Intermediate Maths and Advanced Maths, and that was one of them. Now, again, whether that was they didn’t need it for university – although that was a different question as well, that was one of the reasons, they didn’t need it for university – but they also chose ‘it wouldn’t benefit their life’. Whether they thought that choosing two out of six maths subjects would narrow down their opportunities or their job prospects I’m not too sure, but that would be an interesting one to delve into in future research with some focus group interviews with the students.

JE: So, what were the main reasons then, you mentioned one of them there and there were around six that came through strongly in the percentages.

MJ: So, one of the main ones was that they didn’t want to do two maths subjects out of six – five subjects count towards your university entrance score, schools make students choose six and if you’re at a religious school you do RE, so that’s seven. And the students, flat out, said that they didn’t want to do two out of six as maths and I guess you can understand that.
In addition to the students saying they didn’t want to do two maths out of six or seven in Year 11 and 12, they also said there were other subjects they wanted to study. Looking back at some of the subjects on offer now in comparison to say the 80s or the 90s when I went through school, at some schools there are nearly twice the number of subjects on offer. There’s also TAFE and various VET subjects the students can do.

Given that the universities don’t require Advanced Maths for entry into pretty much any degree in the country, and the fact that there are so many more subjects on offer, I guess it’s not unreasonable for students to say ‘no thanks’ to both Intermediate and Advanced Maths, if they’re a bit unsure about what they want to do. If you’re asking students when they’re 15 to choose their subjects for senior it’s hard because who knows what they want to do when they’re 15, I certainly didn’t.

JE: And, like you say, there are so many subjects now, it’s competing for ‘the audience’ I guess?

MJ: They are competing subjects and a change that has also happened due to technology is that previously 20, 30 years ago the schools would put their subjects on lines and you had to pick one subject from each line. But now with these fancy programs, a lot of the schools just say ‘give us the six subjects that you want to study’ and put them all into the computer, and the computer will spit out the timetable. So there are no real restrictions anymore in terms of what you can study.

Other reasons were that they thought they would find it hard.

JE: That’s interesting. What kind of percentages were they that said it thought it would be too hard, bearing in mind they presumably had reached a point where they could have selected it? Although, I guess we don’t know that until we’ve delved deeper …

MJ: You’d need to have a look at their marks and see what they thought of maths in junior school, in Grades 8-10. Obviously some of them did really well but then thought ‘I don’t want to do two’, but we’re talking 65-70 per cent agreeance that they didn’t think they would do well, they thought it would be too hard and also a lot of work. Which is interesting because when I’ve talked to the students who’ve done both Advanced and Intermediate Maths and said ‘how did you find both of them?’, often they will say that they enjoyed the Advanced Maths more and that it was easier.

JE: We mentioned about influence earlier, what about influence in terms of other
people as reasons for not choosing maths?

MJ: Yes often, certainly in Queensland, we hear the stories about the guidance counsellor or the careers counsellor saying ‘don’t choose Advanced Maths at school, you don’t need it, do something you enjoy, you can always do it at university if you need it’, but the students said that the guidance counsellor had very little influence. In fact, there was no influence on the student’s decision – they weren’t being told by their maths teachers not to do it, they weren’t being told by their parents not to do it, in short it was their own decision. And that was quite a surprising finding.

JE: And friends as well. Again, that’s something you hear isn’t it? We mentioned you spoke to teachers and they thought that they were being influenced, that the friends were an influence in the decision, but clearly it’s not.

MJ: No, that’s right. So, being influenced by friends was one of the questions and the students said no they weren’t, but when I went and asked teachers and the university academics ‘what do you think the reasons were that the students weren’t choosing Advanced Maths?’ the biggest thing they said was that they were being told by their friends not to. So, the teachers and the academics thought that there was influence not to study, not just by friends but also by guidance counsellors and maths teachers and parents. But the students said no, that wasn’t the case at all so that was quite interesting.

JE: So, there’s some interesting reasons on both sides there for choosing and not continuing. What are the implications for educators? One of the things that popped out when I had a look at some of those stats was on the reasons for choosing, one of the popular ones was they enjoyed it in junior school. So, it was about enjoyment of maths – that’s obviously quite a big implication isn’t it for fostering that enjoyment I suppose.

MJ: Yes, it is. There were some students who chose not to do Advanced Maths, even though they clearly enjoyed it at school. And I guess coming back to my point before about the students saying they enjoyed Advanced Maths and found it easier than Maths B (Maths B being Intermediate Maths) is an important one because the Intermediate Maths course in Queensland and most states is very calculus heavy, and there’s a bit of probability and stats there as well. Whereas the Advanced Maths course has a bit of calculus, but then it’s got some vectors, some matrices, complex numbers and then, in Queensland at least for the next two years until we adopt the National Curriculum, schools have a choice of what they would like to teach for two of the eight units. So there’s quite a lot of variety, it’s not just the same old things that you tend to see in Intermediate Maths.
And so I think telling the students more about what is in the Advanced Maths course – that it is more than just the same thing over and over again – broadens their mathematical thinking and having that extra two years of mathematical thinking, and different maths, certainly plays an important part if they’re doing a maths-based degree at university. And I’ve found that in some other research that, particularly the Engineering students who have done both Intermediate and Advanced Maths at school, certainly do a lot better in their maths courses and in Engineering overall.

JE: So, it might be about removing some of that fear factor then, I guess?

MJ: It’s a bit unfortunate because you think Advanced Maths, just because of the word ‘Advanced’ that it must be harder, but that’s not necessarily the case, and certainly in Queensland according to most of the students that I’ve spoken to, they say that actually it’s a bit easier than Intermediate Maths and more enjoyable. It’s unfortunate I guess because of the terminology used; even in Queensland we call them A, B and C – and so you think that C, by default, is the hardest one, where in fact there’s a lot more variety and it seems to be more enjoyable.

That’s all for this episode – to keep listening or to download all of our podcasts for free visit acer.ac/teacheritunes (http://acer.ac/teacheritunes) or you can head to www.soundcloud.com/teacher-ACER (http://www.soundcloud.com/teacher-ACER). Of course, you can check out the full transcript of this podcast www.teachermagazine.com.au (http://www.teachermagazine.com.au), where you can also access the latest articles, videos and infographics for free.

Michael Jennings shared details of his research at this year’s MERGA (Mathematics Education Research Group of Australasia (https://www.merga.net.au/)) conference.

According to this research, some students chose not to do Advanced Maths because they thought it would be too hard. As a maths teacher, do you explain to students what the course involves, what will be expected of them, and share examples of content and the topics they’ll be studying?

National data show student participation in advanced maths subjects is declining. What’s happening at your school? Have you asked students about the reasons they choose (or don’t choose) a particular subject?