



EDTECH

Maths Pathway turns high-impact pedagogy research into practice

Adam Inder, Data Analysis and Curriculum Innovation Manager, Lake Joondalup Baptist College

When talking to both the expert in education and the uninformed, there is a common refrain which claims that the current education system is broken for a variety of reasons. We all know an example of a student who has fallen through the cracks or has simply not been the 'right fit' for school – you may even be someone who considers yourself part of this category. The reality is that the teacher's job is becoming more complex as expectations pile up. Meanwhile, the world around us is rapidly changing through the develop-

ment of technology, increased globalisation and the job availability tied to these two things. It can seem at times like we have more problems than solutions.

Maths Pathway is an organisation which was featured in the Term 1 issue of *Education Today*. They provide a teaching and learning model which (put simply) provides rigorous learning opportunities within an individualised framework. Teacher experiences of those who have used the model suggest that this model is a potential (partial) solution to the overwhelming demands placed on teachers and the tendency for some students' needs to not be met within the traditional

classroom. The justification for this claim will be unpacked below by referring to the research which underpins the thinking, as well as the data which I have witnessed in two schools – one with a low socioeconomic status and one with a high socioeconomic status. Although Maths Pathway is only used in the mathematics classroom, I am certain that its model and the thinking behind it have scope to be translated into other subject areas.

What is Maths Pathway?

Maths Pathway is a teaching and learning model which assists teachers to facilitate a unique teaching and learning

approach. To date, over 57,000 students are participating in the Maths Pathway style of teaching and learning (Maths Pathway, 2019a). Although Maths Pathway originated in Victoria, schools all across Australia – from Katherine to Christmas Island – are now using the model.

Maths Pathway performs extensive diagnostic tests to determine the current mathematical level of any student, including any gaps they may have in their skills and knowledge. Students complete chunks of work built around a mathematical concept called ‘modules’ which are either assigned by teachers, chosen by students or a mix of both. For students to ‘pass’ the module and move on to more challenging modules, they must score 100% in a module at the end of a two-week test cycle. The 100% is indicative of demonstrated mastery and is considered strong evidence that the gap in understanding has been closed. At the end of each test cycle, teachers host individual feedback meetings with students where feedback on effort, growth and accuracy are explored and students set goals to work towards for their next test cycle. Mathematical rich tasks are embedded into the test cycles which will be explored in the corresponding section following.

The following sections will address the research behind five of the ‘eight components of [the Maths Pathway] Learning and

Teaching Model’, reinforcing how and why these components agree with the research behind effective teaching and learning.

1 Personalised learning

In the 2018 Gonski review, it is claimed that students ‘should be challenged and supported to progress and excel in learning in every year of school, appropriate to each student’s starting point and capabilities’ (Department of Education and Training, 2018). Geoff Masters discusses this in a 2018 article, acknowledging that ‘most teachers understand this and attempt to teach every student at an appropriate level. But they work within external constraints’ (Masters, 2018). Logistically, teachers find personalised learning extremely difficult to execute effectively. Being bound to a crowded curriculum gives little opportunity to differentiate to such an extent. Teachers being increasingly time-poor during the term means that flexible yet individually tailored lessons are difficult to execute on the fly.

Masters gives a recommendation for an amendment to these constraints: ‘Instead of packaging the curriculum into year levels, wherever possible the curriculum would be presented as a sequence of increasing proficiency levels in a subject’ (Masters, 2018). Maths Pathway does exactly this. Beginning with an extensive

series of diagnostic tests, students’ current levels of learning are determined and recalibrated as students undergo modules predicted to be within their Zone of Proximal Development (Vygotsky, 1987). As discussed in the book *Breakthrough*, classroom practice should be structured into a practical, precise and highly personalised manner for each student, with progress (and naturally, increased achievement) being the aim for all students (Fullan, Hill, & Crévola, 2006). Much of John Hattie’s *Visible Learning* research agrees with personalised learning, with ‘Appropriately challenging goals’ demonstrating an effect size of 0.59 and ‘Teacher expectations’ demonstrating an effect size of 0.43 – both above the ‘hinge point’ of 0.40 (Hattie, 2018). If teachers can use Maths Pathway to set appropriately challenging goals and calibrate their expectations of students to this appropriate level of challenge, we are likely to see increased success in the classroom.

2 Differentiated assessment

With personalised learning, we require a means of providing differentiated assessment to students. As mentioned above, for students to ‘pass’ any chosen module and move on to more challenging modules, they must score 100% in a module at the end of a two-week test cycle. Hattie’s

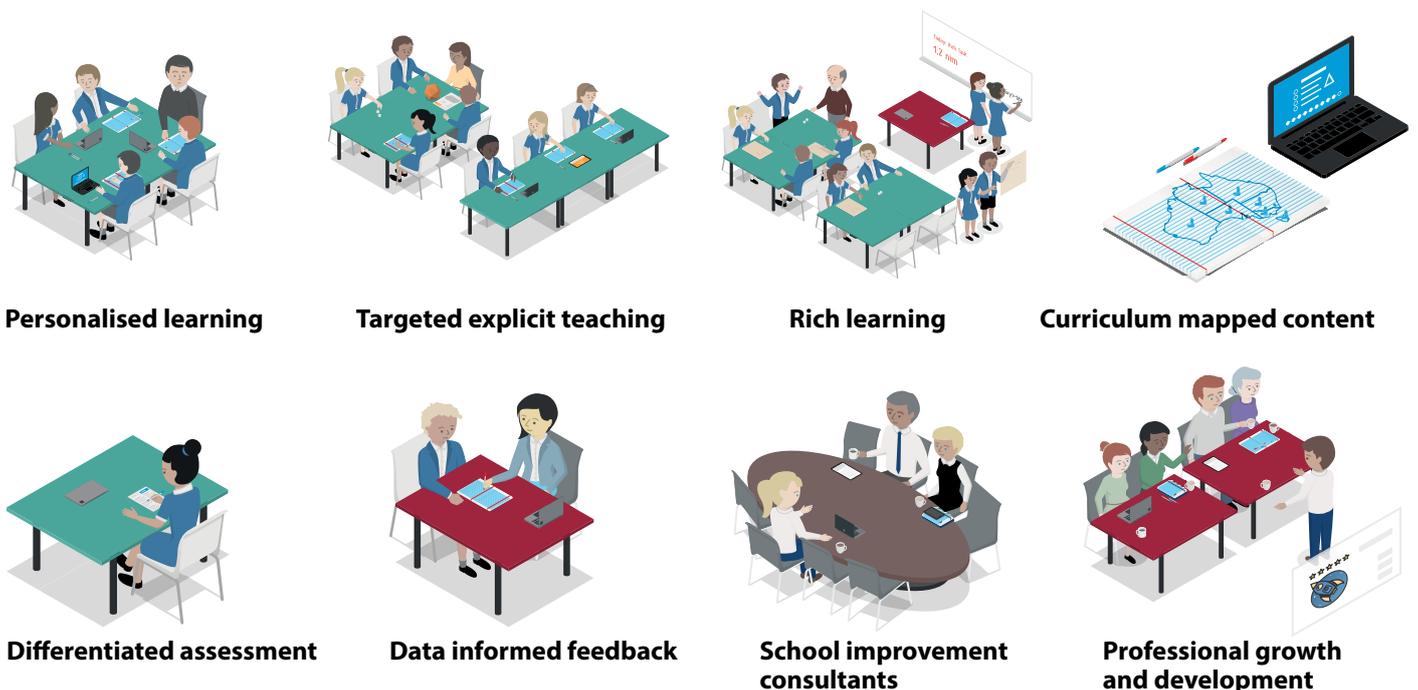


Figure 1 The eight components of the Maths Pathway Learning and Teaching Model

Year	Grade	1	2	3	4
2018	7	102%	109%	103%	101%
2019	7	121%	108%	97%	N/A
	8	114%	138%	177%	118%

Table 1 Clarkson Community High School class average growth rates 2018-2019

Visible Learning research has shown us that mastery learning has an effect size of 0.57 (Hattie, 2018). The assessments incorporate an online test section and also a written section, mirroring the balance in online and written components of all modules. Technology in mathematics is shown to have an effect size of 0.33 (Hattie, 2018), but we are still bound by a curriculum that relies on written paper tests for Years 11 and 12. Not only this, but it has been shown that note-taking by hand is better for retention and deeper processing than typing on a keyboard (Mueller & Oppenheimer, 2014). Maths Pathway manages to find a balanced position in the middle without making the process too awkward for students and teachers to operate.

3 Data-informed Feedback

First, following receiving their test results, students have an opportunity to personally reflect on the work they have done. ‘Evaluation and reflection’ has been shown to have an effect size of 0.75 (Hattie, 2018) which indicates a very high potential driver of success.

When students complete assessments, they are given feedback based on three areas of data:

- Effort (The number of modules a student completes)
- Accuracy (The number of modules a student has mastered as a proportion of their total modules completed)
- Growth (The number of modules the student demonstrated mastery of).

When a student completes work for a high number of modules, it means that they are putting lots of effort in to head towards a higher growth rate. If a student has low accuracy, it means that they are not mastering as many modules as they attempt, meaning that they are not studying effectively or are perhaps overstretching themselves with the workload. Growth is a measure which compares to expected progress. When achieving a 100% growth

rate, a student is gaining the equivalent of one year’s worth of learning for one year of instruction.

With this suite of data at their fingertips, the teacher can use this to provide targeted feedback with students. At the end of every test cycle, a teacher has a short feedback meeting with a student to guide them for the next cycle. It may include reference to their learning goals, how much they have written in their book or may look at their effort in preparing for their test. Feedback is centred around growth, as Maths Pathway creators are strong advocates for promoting a growth mindset (Dweck, 2006). This is perhaps my favourite element within the Maths Pathway ‘recipe’. This thinking is in agreement with the recommendations from the 2018 Gonski review (Department of Education and Training, 2018). Meetings adhering to Maths Pathway recommendations are short but targeted and practical, indicating an understanding of even the most recent of Hattie’s research on feedback:

‘That students are taught to receive, interpret and use the feedback provided is probably much more important than focusing on how much feedback is provided by the teacher, as feedback given but not heard is of little use’ (Hattie & Clarke, 2018).

4 Targeted explicit teaching

Explicit teaching (sometimes oversimplified as the ‘I do, we do, you do’ model) is a highly effective teaching strategy, as indicated by its effect size of 0.57 in the *Visible Learning* research (Hattie, 2018). As work is differentiated for every student, Maths Pathway uses explicit teaching in the form of ‘mini lessons’. Students completing a common concept are grouped together. While other students are working independently on their own modules, the small group of students are explicitly taught fundamental concepts relevant to their common module(s). When students

are working independently, if they require help, they are able to identify students who have mastered the module they are attempting. This allows them to seek help in the form of peer tutoring – which has an effect size of 0.57 (Hattie, 2018).

5 Rich Learning

A common misconception about Maths Pathway is that it is a ‘set and forget’ teaching strategy which places students on computers and leaves them to their own devices. Implemented correctly, this is far from the case. Test cycles are broken up with sessions of ‘rich learning’ which are comprised of ‘high-ceiling, low-floor’ activities which may involve elements of collaboration. These exercises promote critical thinking as in agreement with mandates set by the Australian Curriculum General Capabilities (Australian Curriculum Assessment and Reporting Authority, 2019b) and other widely agreed upon documents such as *The Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008). Rich learning tasks for a variety of curriculum topics and skill levels are provided, meaning that teachers do not need to reinvent the wheel – a task we teachers are particularly renowned for undertaking ad infinitum.

Success irrespective of socio-economic status

In 2018, I was working at Clarkson Community High School (CCHS), a socioeconomically disadvantaged public school in the northern suburbs of Perth, Western Australia. CCHS has an Index of Community Socio-Economic Advantage (ICSEA) value of 946 (Australian Curriculum Assessment and Reporting Authority, 2019a), whereas an ‘average school’ in Australia has an ICSEA value of 1000, indicating the disadvantage that CCHS experiences. 2018 was the first year of CCHS implementing Maths Pathway, starting with its use in the Year 7 Mathematics classes.

Year	Grade	1	2	3	4	5	6	7
2017	7	133%	125%	142%	153%	138%	138%	134%
2018	7	178%	145%	133%	155%	207%	128%	210%
	8	122%	102%	118%	114%	100%	92%	78%
2019	7	218%	236%	205%	154%	196%	172%	N/A
	8	166%	184%	140%	165%	114%	163%	N/A
	9	82%	65%	126%	90%	85%	98%	N/A

Table 2 Lake Joondalup Baptist College class average growth rates 2017-2019

CCHS is a very complex environment to work in – student transiency is extremely high, as many as 85% of students have a language background other than English (Australian Curriculum Assessment and Reporting Authority, 2019a) and teachers need to consistently demonstrate effective behavior management in order to maintain classroom order. Despite these complications, CCHS Mathematics classrooms found great success in their use of Maths Pathway, and this has continued into 2019.

At CCHS, the overall trends seems to be that classes experience average growth rates of over 100%. This means that students learn, on average, over one year's worth of content for one year of instruction. Many studies confirm that a student attending a low-SES school is likely to have lower results than a similar student who attends a high-SES school (OECD, 2016; Perry & McConney, 2010). For a disadvantaged school which is prone to so many negative compositional effects, achieving at or above the expected level of growth is a tremendous victory. Studies have shown that students from low-socio-economic status (SES) backgrounds have the most to gain from high-quality teaching (Leigh, 2010) and Maths Pathway provides a structure to facilitate this.

In 2019, I started my new role at Lake Joondalup Baptist College (LJBC) – a high-ICSEA independent school approximately ten minutes south of CCHS. LJBC has an ICSEA of 1112, indicating a considerable level of advantage above an average school. LJBC had already implemented Maths Pathway for two years prior to my arrival.

The third year is of particular interest, as we will see Year 7s who started using the program now sitting NAPLAN as Year 9s. We are curious to see how their

development in the classroom will translate into the realm of high-stakes testing.

At LJBC, we can see many classes performing far above the 100% growth rate. It is noted that the Year 9 cohort in 2019 is experiencing many growth rates below 100%. As we have only taken the average from Term One, this sample is not as reliable as other years. Nonetheless, it does spark some questions about our approach for this uncharted area.

Firstly, we are now dealing with Year 9 students – a year group renowned for unusually poor behavior linked to their hormones and neurological development. Secondly, many students with learning gaps as far back as Year 1 level have now likely filled these gaps – the 'sugar rush' has worn off and students are tackling conceptual content more appropriate to their level of cognitive capacity. Overall, however, we have seen a historical pattern of growth and success as indicated by growth rates over 100%.

Despite the effect size of 0.52 that socioeconomic status can have on learning (Hattie, 2018), the considerable benefits which Maths Pathway provide in amending the contemporary structure of the mathematics classroom seem to have a greater impact based on the data we have seen above. Such a comprehensive framework for teaching and learning offers hope for the future that all students – regardless of their background – can experience high academic progress.

References

Australian Curriculum Assessment and Reporting Authority. (2019a). Clarkson Community High School. *MySchool*. Retrieved from <https://www.myschool.edu.au/school/48247/profile/2018>

Australian Curriculum Assessment and Reporting Authority. (2019b). General Capabilities. *Australian Curriculum*. Retrieved from [\[curriculum.edu.au/f-10-curriculum/general-capabilities/\]\(https://www.australian-curriculum.edu.au/f-10-curriculum/general-capabilities/\)](https://www.australian-</p>
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Department of Education and Training. (2018). *Through Growth to Achievement: The Report of The Review to Achieve Educational Excellence in Australian Schools*.

Dweck, C. S. (2006). *Mindset: The New Psychology of Success*: Random House Publishing Group.

Fullan, M., Hill, P., & Crévola, C. (2006). *Breakthrough*: Corwin Press.

Hattie, J. (2018). *250+ Influences on Student Achievement. Visible Learning Plus*. Retrieved from https://us.corwin.com/sites/default/files/250_influences_10.1.2018.pdf

Hattie, J., & Clarke, S. (2018). *Visible Learning: Feedback*: Routledge.

Leigh, A. (2010). Estimating teacher effectiveness from two-year changes in students' test scores. *Economics of Education Review*, 29.

Masters, G. (2018). Gonski's model for schools. *Teacher Magazine*. Retrieved from https://www.teachermagazine.com.au/columnists/geoff-masters/gonskis-model-for-schools?utm_source=CM&utm_medium=bulletin&utm_content=May15

Maths Pathway. (2019a). About Us. *Maths Pathway*. Retrieved from <https://mathspathway.com/about-us/>

Maths Pathway. (2019b). Our Model. Retrieved from <https://mathspathway.com/our-model/>

MCEETYA. (2008). *Melbourne Declaration on Educational Goals for Young Australians*. Melbourne

Mueller, P. A., & Oppenheimer, D. M. (2014). *The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking*. *Psychological Science*, 25(6), 1159-1168. doi:10.1177/0956797614524581

OECD. (2016). *Low-Performing Students*: OECD Publishing.

Perry, L., & McConney, A. (2010). School Socio-Economic Composition and Student Outcomes in Australia: Implications for Educational Policy. *Australian Journal of Education*, 54(1), 72-85. doi:10.1177/000494411005400106

Vygotsky, L. (1987). *Zone of proximal development. Mind in society: The development of higher psychological processes*(5291).