

Maths: The snowball effect that makes students think they are 'bad at Maths'

When I started tutoring, my first goal was always to identify why a particular student was struggling with Maths. Whether for a student currently failing, or a student who couldn't quite seem to get that A+, in both cases there was a disconnect between the current and desired outcome.

It didn't take long to see a common pattern. The large majority of my students struggled because their understanding of older content was lacking.

Take fractions as an example. I would regularly find that students preparing for GCSEs were not comfortable with the very basics of fractions: addition, subtraction, multiplication, and division. Yet these are topics that are taught in primary school, albeit not very well but that's for another time.

My point is that I would regularly have to jump back a couple grades in my content and spend a few lessons bringing them up to speed.

So that's the problem solved? We can move on?

Well, not yet. It's all well and good to recognise this gap in understanding, but we can also dig a little deeper to understand the implications of not catching this problem early.

As a tutor, you're not always in the best position to identify the root problem. After all, you only see the student outside of the classroom. You have little control over what happens within school walls.

During my teaching diploma, however, I got to experience life on the other side. I taught many Maths classes at secondary schools in New Zealand, and was able to witness first-hand how students struggling with Maths wrestled with the school curriculum.

It was here that I began to see the problem. Struggling students would spend the entire lesson working on older content.

Perhaps this is okay though? After all, any learning is good? Again, it's not so simple. Lessons are often designed so that you follow a clear path through the course content. Even if you manage to develop your understanding on the older material during one lesson, you've now fallen behind on what you were supposed to be learning.

Consider an example. Let's imagine we have a lesson teaching Pythagoras' theorem, which describes the length relationship between the sides of a right-angled triangle. In the example below, there are two main steps involved for finding the value x .

Pythagoras' Theorem

$$a^2 + b^2 = c^2$$

① Re-arrange for a :

$$\Rightarrow a^2 = c^2 - b^2$$

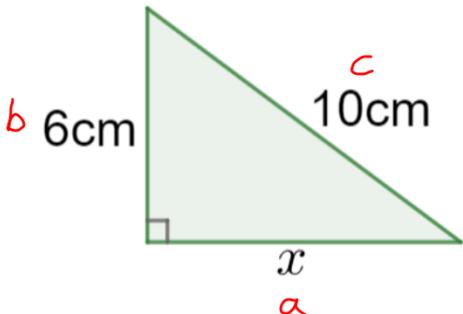
$$\Rightarrow a = \sqrt{c^2 - b^2}$$

② Sub in values for b & c

$$\Rightarrow a = \sqrt{10^2 - 6^2}$$

$$\Rightarrow a = \sqrt{100 - 36}$$

$$\Rightarrow a = \sqrt{64}$$

$$\Rightarrow a = 8 \quad \checkmark$$


Problem one: Finding the missing side length using Pythagoras' theorem (demonstrated using the digital whiteboard software Openboard).

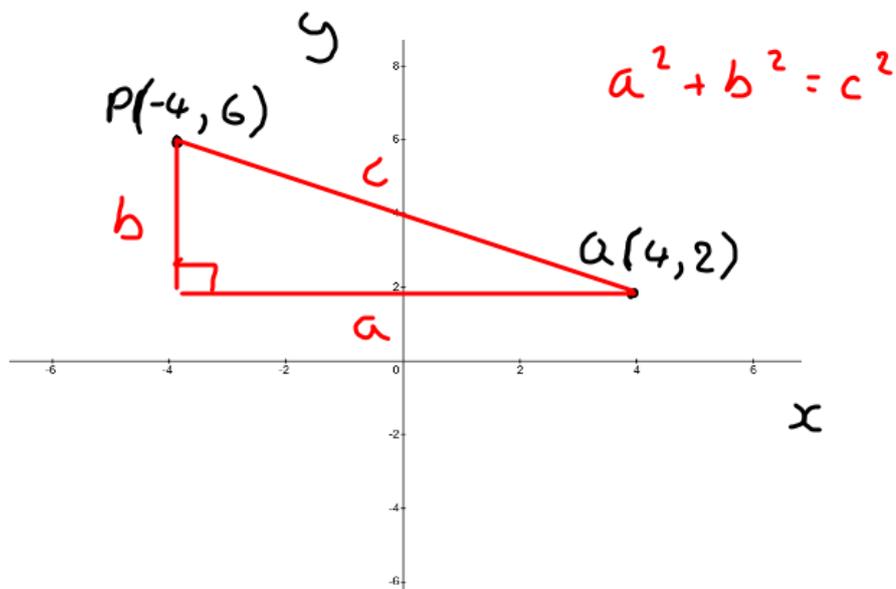
First, we re-arrange Pythagoras's theorem to make a the subject of the equation. Second, we sub in the values for b and c , and solve.

What is the key learning I want to teach through this problem? Well, as I said, I want to teach the students about Pythagoras' theorem, and how to apply it.

But what if the student isn't comfortable with basic algebra? Well, they won't be able to understand step one and, without step one, they won't fully comprehend how to apply Pythagoras' theorem. **This is where the snowball effect comes in.**

Imagine now that the next lesson, I ask students to solve the problem of finding the distance between two points on a graph. The expectation is that they'll apply Pythagoras' theorem to solve this problem, as demonstrated in the image below.

Q) Find the distance between points P and Q.



Problem two: Finding the distance between two points using Pythagoras' theorem (demonstrated using digital whiteboard software OpenBoard)

Hang on though... some students hadn't learnt to apply Pythagoras' theorem in the previous lesson. How can they solve this problem?

Sadly, they can't. They will spend another lesson wrestling with basic algebra, and will fail to learn how to apply Pythagoras' theorem to find the distance between two points. You can start to see where I am going with this.

What starts as one gap in understanding snowballs into the student failing to absorb many new topics that are introduced to them. The end result is you have children who believe they are 'bad at Maths', because it's been months, or even years, since they left a Maths classroom feeling like they met the intended learning objectives.

This is a sad thought, and has clear implications on how well we might expect these students to learn within the classroom. A student continuously wrestling with old material is likely to feel frustrated with Maths. Teachers also don't have much time to spend with a struggling student. After all, they also have to keep up with a fast-paced curriculum.

There's no easy answer to fixing this problem, and proposing one isn't the intention for this post. My hope, for now, is that we re-consider what someone who is 'bad at Maths' looks like.

I believe that the difference between a student doing well and not doing well is not a matter of natural ability. Rather, for one student, **a key piece of learning was missed along the**

way, and never caught up. With this view, we are in a better position to understand student frustrations, and work with them towards a better relationship with Maths in the future.