

Teacher hack 1.2: Leverage the confusion

When making room for alternative practices, we must accept that students will probably behave unexpectedly—and undesirably. Yet we must allow time for unexpected, not-so-perfect behaviour. There's no other way to ignite the change! Be bold and trust your students to respond to your proposal.

- ▶ Be prepared to face anything: For example, if some of your high achievers became frustrated with the Doggie Examination activity, your job is to support them readjusting their maths identity. Don't get scared and think the activity was faulty.
- ▶ If the activity feels uncomfortable, it doesn't mean we shouldn't proceed with it.

This is what once happened to me: I came across an exam question saying something like: 'Cassandra has \$15 and then she loses some. How much does she have left?' Turned out that the question triggered pure outrage when shared on social media: *This could not be solved! This was not a mathematical question! There was no correct answer to this!*

Some of my students reacted the same way. But some of them got excited—and everyone got engaged.

Maybe the exam question had been accidentally abridged. But it shows us that by leaving out details, we can transform a closed question into an open one.²¹

Leverage the confusion: How?

The teacher skill we are tackling:

Specifying and reinforcing productive student behaviour.

Since an open task isn't about getting to the one and only answer, we might feel a bit helpless in determining how to scaffold the activity. Instead of focusing on the solution, we have to focus on the quality of reasoning. That's why we need the idea of *if... then* reasoning.

In the case of Cassandra's money, first, if we assume it is true that she actually lost some money, and then it is absolutely correct to infer she now has less than \$15. In that case, we do know that the answer is in a range of $0 \leq x < 15$.

We don't know whether she lost full dollars or also cents, so we can make further assumptions: *If* the loss was entire dollars, *then* she would now have something between zero and 14 dollars. Further, we can make repetitive calculations (these are especially appealing to younger children). *If* she lost \$3, *then* she would have \$12 left. *If* she lost \$7, *then* she would have \$8 left. What *if* she lost \$9.20? *Then...* do we know how to handle decimals? Let's take our mock money and try to figure this out!¹²

In the case of truly incorrect thinking, such as 'If she lost \$6, then she would have \$2 left', we can turn it around and let the students find the failure: Well, if she had \$2 after having lost \$6, did she really have \$15 at the beginning? Not \$15, but \$8. Maths doesn't get broken if learned through mistakes. Examining the incorrect reasoning is still a subtraction exercise.

Practice activity 1.2

As a second practice activity, let your students discuss what happened to Cassandra's money. See if you can leverage the confusion. Show your students the activity below. It suits all age levels. Allow 5-10 minutes. Try to establish *if... then* reasoning.

Lost treasure?

Cassandra has 15 dollars, and then she loses some. How much does she have left?



When you see students again becoming frustrated with an open task, remember the findings of American mathematics researcher Hiroko Warshauer.¹³ She noted that we tend to see struggle as something negative, but there are great benefits that come from learning how to overcome the struggle.¹⁴

I notice these benefits every time I am too busy with one group to give support to another. Once I finally get to the ones who were calling for help, I found that they were all engaged and had resolved the problem by themselves. This is what Warshauer calls *productive struggle*.

One of the biggest challenges in promoting productive struggle comes from lacking confidence in students' perseverance. Try the following trick: When you feel like your students might give up, do not give direct advice but instead ask them to explain with words what they *have* done so far. This almost always helps. If it doesn't, repeat what they have told you and emphasise what sounds reasonable. Then promise to return and leave the group to productively struggle for another moment, now a bit more spiritedly.

In *Seriously Fun Maths*, Dr Laura Tuohilampi changes the narrative of mathematics education into something fascinating, intriguing and something that touches every human. Based on her cutting-edge research she challenges the outdated ways of motivating students around maths.

This engaging book provides teachers with research, resources and activities to teach a lesson a month. The rich activities are accessible to young students and deep enough for secondary students. Even adults!

This book will help mathematics educators reflect on their skills of orchestrating mathematical discussions and problem-solving. They will learn how to increase students' engagement in ways that reduce stress-inducing expectations around what a 'good' student in maths can and cannot do. Teachers will improve their grasp of what's important—making mathematics a meaningful experience.

Everyone will have serious fun while learning maths!



Dr Laura Tuohilampi (University of New South Wales (UNSW) Arts, Design and Architecture) is a mathematics education researcher, an inservice teacher trainer and the founder of Math Hunger and Maths for Humans. Passionate about shifting mindsets to recognise maths as positive, engaging and achievable, her work explores practices that are innovative, engaging and which seek to inspire teachers. Laura is a multi-award-winning researcher, who focuses on interest development, engagement and the social and contextual aspects of learning mathematics. This is her second book, but first international publication.

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