HOW TO TEACH

Anyone can feed sweets to sharks ...

Primary Maths

Nick Tiley-Nunn
EDITED BY PHIL BEADLE

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FOREWORD BY PHIL BEADLE

Nick Tiley-Nunn might be the best teacher in the world. He is certainly the best I've seen. Ever. I've never seen anyone, ever, who has gifts anywhere near the level he's quite so blithe and modest about. "I do my best," he shrugs with a disarming and ingenuous smile. Seated at the back of his class in a small room in an area of London I'm never really comfortable in, having taken a job doing a teaching and learning audit for a quite brilliant school, Radnor House, I witnessed, for probably the second time in my career, an untutorable genius at work. Halfway through the lesson, I turned round to an awestruck 9-year-old girl, who was learning about division through seeing how many sweets a shark might eat given the opportunity. I asked her a question, "Is he the best teacher in the world?" She was utterly certain, "Yehhhhhhhhh! Of course. Everyone knows that!"

My observation notes from the time noted: "This is the best maths lesson I have ever sat in on. The students adore him and rightly think he is the most brilliant teacher they have ever had. He has invented techniques that every maths teacher in the country could learn from, combines rote and kinaesthetic learning, which is something that only the most profoundly brilliant teachers are able to conceive of, and, like the masterful football player who vibrates on a different string to anyone else, has enough time on the ball to divert into accidentally teaching kids about alliteration. He is a stunning talent."

And this is not my opinion alone. Here is the view of one of Nick's former colleagues, Kate Ryan who currently leads a group of eminent educators in driving improvement in education systems globally: "Nick is simply unparalleled. He is limitless."

The idea of the How To Teach series of books is that teachers encounter the geniuses of the form. Primary maths is not a realm I have any real knowledge of, but I know class when I see it, and Nick Tiley-Nunn, as a practitioner, is next level brilliant.

Of the man who wrote this book: he is unassuming, doesn't recognise the fact that he is even talented, and is the kind of quiet, deeply gentle and sweet man you would want your grown-up daughter to bring home. Where his genius came from, I don't know. It appears either a genetic accident or the result of a boisterous child who was taught, at school, that maths was really boring, and who wanted to prove it didn't have to be, and that it was a matter of the teacher's intent: their seriousness in finding the (surface level) frivolity. Wherever it came from, it is there, and I leave you to commune with it, and see if you agree with me; furthermore, to see if you can infect your class with the same total absence of boredom any child who is lucky enough to be taught by Mr Tiley-Nunn experiences every day.

INTRODUCTION

NUMERATE OR MATHEMATICALLY LITERATE?

I call one of my favourite lessons on teaching division, "Anyone can feed sweets to sharks" (I will explain later). It also serves as a metaphor for the way many of us feel when we first step into the classroom as teachers. When I started teaching, I was barely old enough to make my own packed lunch, and I remember the terror of entering a classroom full of 'sharks' waiting for me to 'feed' them 'sweeties' of knowledge. "What if I run out of sweets? What if they get a taste for teacher flesh? This is a bad idea! RUN!"

Some claim that they thrive on fear, some leave the profession because of it, but all teachers have felt its icy finger at some point. It's a universal teaching experience. For primary teachers, it doesn't matter that the 'sharks' are only little – they still bite!

We've all got our own specialisms and deficiencies: there are elements of the job we feel confident about and elements where we feel a bit out of our depth. For the majority of primary teachers, one subject, above all others, fills us with trepidation and fear: mathematics – the Marmite subject.

I wasn't the most successful mathematician at school. I was alright when it was just about simple arithmetic: my brain could punch out answers at a fair rate. However, when it came to writing down my workings, the game was up. Everything about this more formal approach to mathematics seemed

to be an elaborate plot devised to make me look like a muppet. Getting my unwieldy numerical scrawlings to fit into neat little boxes was a problem; I was struggling to keep my writing on the page, let alone in strict cm^2 cells and neatly aligned in columns. I persevered with it, though, because I wanted to be a good boy and to do well at school. However, lessons spent trying to work out how much Sanjay was going to pay for a bag of apples were wasted on me; I was too busy working out whether I was going to be a Power Ranger or one of the X-Men at breaktime.

The real shame is that I wasn't 'bad' at maths, I just never caught the bug: numbers written neatly in grid-lined exercise books couldn't compete for me with the fizzes and bangs of science, the gruesome accounts of battles won and lost in history, the exploration of stunning landscapes and cultures in geography, the endlessly entrancing stories of English or, most notably, the thrill of chasing a ball around a sports field. To be honest, even French lessons, with their seemingly never-ending learning of tenses, were above maths in my hierarchy of subjects that I cared about.

Throughout my school life, there were very few memorable maths moments. I remember making an awesome macaroni abacus in Year 1, and there was the time in Year 3 when Charlie almost choked on a Unifix cube and threw up over the desk. In Year 6, we had to measure the dimensions of the classroom and didn't have any tape measures, so we created the longest ruler known to man, which at morning break became the longest lightsabre known to man.

The secondary school years were worse. Confined to the realms of mediocrity in set four out of seven, I whiled away each lesson hoping that the teacher would not linger too long over my workings for fear that his body odour was contagious. Even so-called 'project work' was reduced to working out how much a school trip to the zoo would cost or measuring the height and shoe size of the pupils in my class. The highlight would be the occasional trip to computer room to create a spreadsheet to demonstrate our 'findings'. If I could sum up my maths education as a colour it would be beige, as a

flavour it would be tapioca, and as a hobby it would be coin collecting. The most worrying thing was that I knew maths was supposed to be important, but I couldn't see how or why: it was neither culturally nor contextually rich. For me, maths just never added up. You could not have paid me to study mathematics after GCSEs, a sentiment which was shared by all of my class as none of us went on to study maths further.

WHY DON'T PEOPLE LIKE MATHS?

The majority of primary teachers have not studied mathematics at a higher level. In fact, I would probably go a step further and say that there are more primary teachers who actively dislike maths than enjoy it. There are a lot of primary teachers who would not teach maths if they had any choice at all. They didn't like it when they were at school as a pupil, and don't like it now they are a teacher. They didn't excel in it then, and don't excel in it now.

The social stigma attached to being 'bad at maths' is less pronounced than that of being illiterate. The charity, National Numeracy, carries out an annual survey into adults' attitudes towards maths and numeracy in the UK. The most recent survey, carried out in March 2014, highlights several important points for consideration.[1] First, where 66% of UK adults stated that they would feel embarrassed to tell someone that they were bad at literacy related tasks, only 48% of people would feel the same about telling someone that they were bad at maths. Perhaps of even greater concern is that among those who rated their maths skills as poor, 45% believed that maths is more innate than a learned skill.

1 See National Numeracy, YouGov Survey Findings (12 March 2014). Available at: http://www.nationalnumeracy.org.uk/resources/134/index.html.

Take a moment to consider the message this sends to the children in our classrooms. Over half of the adults in the UK would not be embarrassed to admit that they are poor at maths, and almost half the people who consider themselves to be poor at maths believe that it is mostly down to them not drawing a winning ticket in the genetic lottery. "Well, I was never any good at maths, so what chance has he got?" is a phrase we hear all too often at parents' evenings. Some are even prepared to completely write off their children's mathematical ability at the slightest hint of difficulty in the subject. Another alarming aspect is that this mindset seems to be something that is more prevalent in the UK than in other developed countries.

Chris Humphries, the chair of National Numeracy, is on record as saying, "It is simply inexcusable for anyone to say 'I can't do maths'. It's a peculiarly British disease."[2] And the National Centre for Excellence in the Teaching of Mathematics, in one of their activity packs,[3] makes reference to a discussion about mathematics between academics at an international conference, where an admission of, "Oh, I can't do maths to save my life!" by a British academic is met with sympathetic laughter by the other Brits, but with utter shock from non-English academics, one of whom responds, "We are very surprised to hear you make such an admission in public. It is very embarrassing." The discussion develops further with the explanation that admitting weakness in maths in British society is, "an acceptable thing to do and even makes you sound like a 'good egg' ".

Despite this gloomy outlook on our view of maths in the UK, I believe that there is a relatively straightforward solution. Put simply, children who enjoy mathematics are more likely to perform well.

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2 See National Numeracy, 17m Adults Have Poor Numeracy Skills (press release, 28 February 2012). Available at: http://www.nationalnumeracy.org.uk/news/9/index.html.

3 National Centre for Excellence in the Teaching of Mathematics, Attitudes to Mathematics Activity Pack B: Working with a School Whole Staff Event (n.d.). Available at: https://www.ncetm.org.uk/public/files/2990088/Attitudes%2bto%2bMathematics%2bActivity%2bPack%2bB.pdfB.pdf.

So, what are we going to do about it?

This book is intended to be your solution to the knotty issue of making maths enjoyable for your pupils, and the first step in this is your own attitude to maths! From here on in, I will model the positive mindset that you will need if you are going to make maths as exciting as it can be. Step one is to view yourself as outstanding, or as having the potential to be. By picking up this little collection of ramblings you have made the first step: you are clearly interested in what you do and want to be better at it. This was exactly how I felt about teaching maths. I realised I had a deficiency, and that only thinking positively about it would start me on the road to being any good at it.

Maths is the 'Cinderella' subject of the primary curriculum. It is not the ugly sister that it is often presented as being; it can be the 'Belle of the Ball' if the correct make-up is applied. This book will show you what 'make-up' you can slap on the subject to make it alluring for young people, and will hopefully encourage you to dress mathematics up in the way that best suits you and your pupils.

MATHS VERSUS NUMERACY

A core issue with primary maths is the lack of agreement over what is actually important. The terms numeracy and mathematics are used interchangeably, and many argue that they are one and the same. If we treat numeracy in the same way as literacy, then it's about having the necessary mathematical ability to get by in everyday life. Activities such as being able to add up the cost of the food in your shopping basket and read a train timetable are undoubtedly important, and primary education has an integral part to play in the development of these core skills.

However, I don't really like the term numeracy, or the attitudes that come about as a result of the education system's use of it. The foregrounding of numeracy has us fixated, as a profession, on the four operations of addition, subtraction, multiplication and division. Of course, simple arithmetic is important, but there is rather more to maths than these four operations. Imagine the state of the English curriculum if it concentrated solely on spelling or the geography curriculum dominated entirely by maps. Art is not just painting, music is not just learning the recorder, French is not just learning how to ask where the library is, history is not just the study of kings, religious education does not focus solely on Jesus and PE is not just about forgetting your kit. If the breadth of these subjects was similarly restricted, then how popular would they be with children? How popular would they be with teachers? This is why I feel a slight discomfort with the term numeracy: it highlights the emphasis on arithmetic; on the answer over the problem; on being either right or wrong; on the empirical over the creative.

Being numerate is important, but it shouldn't come at the cost of kids developing a genuine interest in the wider mathematical picture. Likewise, arithmetical skill should not come at the expense of highly developed problem-solving skills. Getting the right answer can be important, but we can learn an incredible amount through getting things wrong.

WHAT IS IMPORTANT IN PRIMARY MATHS?

In my opinion, we must strive to build the foundations of mathematical literacy as outlined by PISA:

> Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned and reflective citizen.[4]

We need to escape from the black and white nature of right and wrong answers and place significantly more importance on the process. I referred earlier to the idea of feeding sharks: what if the sharks were given the opportunity to feed themselves? If a key educational objective is to prepare the next generation of adults to take an active role within society, we have to ask what sort of citizens we want: human calculators or creative thinkers with a practised penchant for problem-solving?

So, back to you dear reader. Regardless of your mathematical ability, one thing I will bet my protractor on is that you're a fantastic problem-solver. It's what you do on a daily basis, it's sewn into the fabric of our profession. On any given day, we deal with an ever-increasing set of problems and attempt to solve them. Some of these problems are pretty straightforward ("David, your handwriting will definitely improve if you hold your pencil with your hand rather than your left nostril.") but others are more difficult, requiring us to take in the often multifaceted nature of the problem before deciding on an appropriate plan of attack. A teacher without problem-solving skills is

4 Organisation for Economic Co-operation and Development, *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006* (Paris: OECD, 2006), p. 72.

about as useful as a helicopter ejector seat. If all of us in the profession share this universal skill, it seems silly not to harness it to improve our teaching of primary maths.

WHY PROBLEM-SOLVING IS IMPORTANT AND HOW TO ENGAGE PUPILS IN IT

> Child A: Errrrrrrm, sir, I think we've got a problem ...
>
> Teacher: Really? Show me what the problem is.
>
> Child B (head stuck inside a cardboard box): I'm stuck! I tried to see if it was the right size for my head, and it's a bit tight. I can't pull it off!
>
> Teacher: Fantastic! Tell me what you're going to do next to solve the problem.

Problems. They are more prevalent than sand in the desert and salt in the sea. And, much like primary mathematics, they are labelled as negatives: we approach them with negativity and view them as a barrier. Given the opportunity to rub a magic lamp and be granted three wishes, many of us might wish for some form of problem to vanish. This is perfectly understandable because problems make life bumpy. Yet it is precisely this bumpiness that has yielded some of the most exceptional human beings and creations that have ever graced our planet. Without water pouring through the hull of the *Syracusia*, Archimedes would not have developed his engineering masterpiece, the Archimedean screw; without the need for an instant and practical light source, Thomas Edison would not have

developed the first light bulb; without the problem of how to create multiple copies of books, Johannes Gutenberg would not have created the first printing press with moveable type.

Without problems, these solutions would have never come to fruition. Like a comic book hero and his nemesis, solutions are nothing without the problem that existed in the first place. We need to treat problems as a mechanism for improvement rather than something that gets in the way of success. By exposing our young learners to problems on a regular basis we not only increase enthusiasm and passion for the subject, but also lay the foundations for creating independent, resilient and skilful learners.

WHAT IS THE GOAL?

Why is problem-solving relegated to the substitutes' bench? It is a bit like that flamboyant play-maker who has the ability to flip a game on its head in seconds, but whom you rarely bring onto the pitch, as he doesn't fit in with the team structure. Problem-solving and investigative mathematics can undoubtedly be a real game-changer, but they are less reliable and are a riskier choice than the steadfast approach of, "Everyone follow teacher, and we'll all be fine". Problem-solving and investigative mathematics require pupils to think for themselves.

There is an interesting analogy here: great maths teachers should be nets not spoons. It's tempting and easy to stand at the front of the class doling out healthy slabs of knowledge before directing the children to answer some questions from a textbook or worksheet independently. And you may think that in doing so you've earned your custard cream at morning break. You haven't! You may even have made matters worse if you have uttered the dreaded phrase, "If you get stuck, put your hand up and I'll come and help,"

and in doing so have dismantled the chances of the children doing any real independent work in the lesson. Their books/sheets/mini whiteboards may be replete with answers, but you have done the majority of the thinking for them. Yes, teachers should teach, but they must also give the pupils the time and space to learn themselves.

Central to the process of weaving problem-solving into the fabric of your classroom is ensuring that you tackle the twin barriers to problem-solving: fear and lack of interest.

REDUCING THE FEAR FACTOR

The key to enthusing pupils about problem-solving is removing the main barrier that prevents independent thought, and that is fear: fear of not understanding, fear of being wrong and fear of being embarrassed. The first step to creating young problem-solvers is to reduce these fears for them. Fair enough, but how do you do this? First of all, a teacher must think carefully about how they react in the classroom when a pupil makes a mistake. A slice of perspective is crucial here. I often ask my pupils, "What's the worst that will happen?" A mistake is rarely-to-never the end of the world, and life will most certainly go on after the error.

There are many reasons why a mistake might have come about: from misinterpreting or misunderstanding the question, to applying a method incorrectly (or applying the incorrect method). But reducing the fear factor must come before trying to support any other difficulties. The kids in your class need to know that if they do not give something a go, they have a zero per cent chance of getting it right, and that even a guess is better than nothing. Once children are less fearful about making mistakes, they are more open to the idea of thinking for themselves. This all contributes to the

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It is not the ugly sister that it is often presented as being; it can be the 'Belle of the Ball' if the correct make-up is applied. This book will show you what 'make-up' you can slap on the subject to make it alluring for young people, and will hopefully encourage you to dress maths up in the way that best suits you and your pupils.

By picking up this little collection of ramblings you have made the first step: you are clearly interested in what you do and want to be better at it. This was exactly how I felt about teaching maths. I realised I had a deficiency, and that only thinking positively about it would start me on the road to being any good at it. See if it works for you too.

Nick Tiley-Nunn is a head teacher at a school in Norfolk, having previously been assistant head and SENCO at a school in London. He has been described as, "A nationally significant talent at maths teaching."

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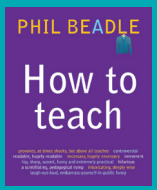

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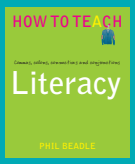

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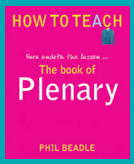

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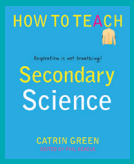

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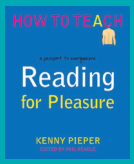

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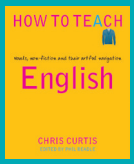

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