

THE PERFECT MATHS LESSON

Totally
Practical

Ian Loynd Edited by Jackie Beere



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Introduction

Delivering the perfect maths lesson is no simple task. My aim in this book is to provide practical ideas and common-sense methods that can help every teacher to be excellent, and uncover the essential strategies that help teachers appear to walk on water (or at least secure an ‘outstanding’ judgement)!

The ‘perfect’ maths lesson?

Teachers have the most important job in the world. At a time when expectations and accountability are at an all-time high, delivering excellence in the classroom has never been more difficult. The perfect maths lesson is about getting it right for inspectors by first getting it right for the children you teach. This book aims to be a pragmatic and down-to-earth guide, recognising that, although no teacher is perfect, their lessons can be. It is about learning and teaching as much as it is about surviving that dreaded lesson observation.

Jackie Beere (2012b) has provided us with a concise overview of the elements of the perfect (Ofsted) lesson. This book builds on her insights but is written with maths teachers and maths lessons in mind. But, like hers, much of this book can

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(and should) be applied in all areas of the curriculum. It is not designed to be a mechanistic checklist of expectations which inspectors will tick for compliance. Instead, *The Perfect Maths Lesson* explores the common features of outstanding maths lessons and the characteristics and habits of outstanding maths teachers. You'll find plenty of Ofsted guidance referenced throughout this book, but bear in mind that this advice has been selected because it is good for children and useful for teachers. Great teachers know what works well for their students despite what Ofsted, or anybody else, has to say on the matter. After all, teachers are not in it for the income; they are in it for the outcome.

Ask any parent or child which subject is the most important at school and we can be confident that maths will feature towards the top of the list. It is true that numeracy (like literacy) is an essential skill for effective participation in the 'real' world, and that, nationally, higher levels of numeracy and literacy are closely associated with market success (see e.g. Chiswick et al., 2003). But placing maths at the top of a hierarchy of school subjects is not necessarily good for maths education. The best learners are inquisitive and curious; they are willing to take risks and think for themselves. Yet too many talented and brilliant children believe that they are incapable because the things they are good at are not valued as highly as the ability to solve equations or simplify fractions. This book aims to help teachers nurture creativity, talent and skill by examining how we can develop the essential elements of outstanding maths education so that children learn to appreciate and love maths.

It remains a concern that secondary pupils seemed so readily to accept the view that learning mathematics is important but dull. They frequently told inspectors that in other subjects they enjoyed regular collaboration on tasks in pairs or groups and discussion of their ideas, yet they often did not do so in their mathematics lessons, or even expect to do so.

Ofsted (2012a: 19)

If you are looking for ideas to breathe new life into your lessons or top tips to gain that elusive ‘outstanding’ judgement, you’ll find plenty in this book. However, becoming a teacher of the perfect maths lesson requires consistent effort and an unwavering commitment to the people that matter most: the children we teach.

Why are we learning this?

It’s a good question, isn’t it? Yet too often I have found myself unable to provide a credible answer to students (at least one that I believed, anyway). Why *am* I teaching this to my class? Am I being constrained by schemes of work, portfolios of evidence, tests and examinations? Do I plan learning episodes based on chapters of the textbook instead of the interests, needs and values of my students? *The Perfect Maths Lesson* is the result of the resistance, revolution and liberation of both teacher and learner that allows mathematics to be

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Engaging Learners in Maths Lessons

Engaging learners in their learning is an essential element of the perfect maths lesson. Students who are engaged in the learning process are more likely to maintain focus and attention, are more ambitious in their thinking and are more resilient when making mistakes along the way. This is because they are intrinsically motivated to learn, meaning that students derive pleasure from participation in the mathematical task itself, from the challenge it presents or from finding its solution. The best maths lessons are the ones during which pupils acquire new skills and knowledge – and love every moment of it!

[In outstanding lessons] teachers and other adults authoritatively impart knowledge to ensure students are engaged in learning, and generate high levels of commitment to learning across the school.

Ofsted (2014: 39)

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One of the key tasks in engaging learners in maths lessons is to set the pace of the learning correctly. A well-paced lesson enables students to tackle difficult concepts without feeling overwhelmed and maintains momentum through easier tasks before boredom sets in. The *pace* of learning is very different to the *speed* at which the lesson moves. In the best maths lessons, teachers do not try to cram too much in and nor do they take too long to get to the main activity. Instead, the pace of the lesson reflects the ability of the learners in the class and the level of mathematics being studied.

The correct pace allows learners to learn without becoming frustrated (your lesson is too easy, too slow or too repetitive) or becoming bewildered (your lesson is too difficult, too fast or too busy). An effective pace is fast enough to maintain focus but not so fast that students become disconnected from the learning. It is slow enough to ensure understanding but not so slow that students become disinterested.

When planning maths lessons, it is useful to think about the following questions:

- Does the pace of this lesson vary with each learning episode?
- Is there a short, snappy activity to set the scene and 'hook' learners into the learning?
- Is there room for reflection and for asking questions? Will the lesson benefit from a gentler pace as the challenge increases?

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- Are there long periods of static, stationary learning that need to be broken up with movement or a change in pace?
- How will I use time limits to keep learning focused?
- Are my resources prepared? How will they be deployed without sabotaging the pace of the lesson?
- Does this lesson involve me talking too much?

Another powerful strategy for engaging learners is to link learning to students' lives. In the perfect maths lesson, students are engaged by solving real-world problems in practical and experimental ways. This might involve planning a holiday, comparing mobile telephone tariffs, plotting routes on a map, breaking a code or monitoring the school's energy consumption. For example, consider how you might build a lesson (or series of lessons) around the following scenarios:

- Imagine two different mobile phone tariffs: the first is a pay-as-you-go tariff and calls cost 35p per minute; the second is a rental contract with a monthly fee of £10 and calls cost 15p per minute. Which tariff gives the best deal?¹
- Calculate the cost of repainting your classroom walls with two coats of paint.

1 This idea was inspired by Teachers TV: Maths KS3: Mobile Phone Tariffs. Available at: <<http://www.tes.co.uk/teaching-resource/Teachers-TV-Maths-KS3-Mobile-Phone-Tariffs-6085220>>.

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- Conduct a frequency analysis of the following Caesar shift cipher to break the code and reveal the hidden message: AOL WLYMLJA THAOZ SLZZVU.²
- You have won a holiday to a destination of your choice! Plan your dream holiday, including all costs, within a budget of £3,000.

Outstanding learning in mathematics is only possible when pupils and teachers are creative in lessons and see mathematics as a necessary part of their lives. [Head teacher Derek Brooks] says: ‘There needs to be a passion for getting inside the key ideas ... pupils need to see that mathematics is something that can be argued about and grappled with. This means that we needed to remove some of the traditional constraints that we know can deliver consistently good and better lessons, and allow teachers to take risks.’

Ofsted (2012c: 1)

Maths teachers need to be cautious, however, and use contexts sensibly and responsibly. Make-believe contexts, used over time, which do not genuinely draw on pupils’ real-world knowledge, restrict children’s interest in maths. As the internet meme asserts, ‘Maths: The only place where people buy 60 watermelons and nobody wonders why’. Make-believe

² See <http://www.simonsingh.net/The_Black_Chamber/caesar.html> for a whistle-stop tour of the world of cryptography. For even more fun, try making Code Wheels with your pupils – see McFall (2013: 158-159).

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contexts will, at best, make maths appear less relevant than other subjects at school and, at worst, will lead to children ignoring contexts altogether, leading to mistakes in their understanding.³ One thing that is sure to capture the imagination of any maths class, however, is a good mystery to solve! For example:

Good morning Year 7. Take your seats quickly and quietly, thank you. Something serious is afoot and I need your help. This is an urgent matter! The school is experiencing a sequence of burglaries and the head teacher has asked for your assistance in bringing those responsible to justice. On Monday, Mr Jones in room 1 found that his dictionary had been stolen. On Tuesday, Mrs Davies in room 2 discovered that her oil paints were missing. On Wednesday, Miss Edwards in room 4 noticed that her metronome had been taken. Today is Thursday. You must determine where our thief will strike next so that we can catch them in the act!

This introduction to sequences is certain to engage learners as they compete to be the first to convince the teacher that they hold the key to solving this crime. Perhaps room 7 is next to be targeted? Possibly room 8? Extend learning by considering where the thief will strike on Friday. Rooms 11, 12 and 16 are now all contenders, which can lead to detailed dialogue about common ratios, indices, quadratics, Fibonacci and more. Moreover, a little ‘friendly controversy’ will hold

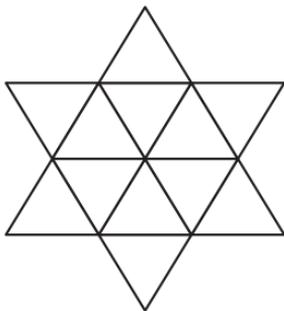
³ According to Boaler (2009: 45), children will, over time, learn that to succeed in ‘mathsland’ you must leave your common sense at the classroom door!

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learners' attention as they discuss, debate and critically evaluate one another's possible solutions.⁴

Getting the perfect maths lesson off to the right start is crucial to engaging learners. An effective initial activity sets the tone for the rest of the learning and can determine the success (or otherwise) of the lesson. Your pupils need to be in the habit of beginning their learning as soon as they walk through the door of your classroom. As they wait for others to arrive, it is a good idea to have a little, open-ended challenge available on the board or on their table. For example:

- How many ways are there to make 10 pence using British coins?⁵
- How many days/hours/minutes are left until the end of term?
- How many triangles are there in this diagram?⁶



4 See Gary Rimmer's *Number Freaking* (2006) for a cheerfully absurd collection of surreal everyday arithmetic.

5 There are 11.

6 There are 20.

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Tackling a fun initial challenge individually or in pairs as soon as they walk into your classroom will mean that pupils *want* to arrive early and start working immediately. This makes a very good impression on any observer or inspector that may one day visit your lesson. It also avoids the time wasted for your lesson to commence, particularly if the class have just had PE!

An alternative to these little, open-ended challenges is an ongoing task which students can revisit at the beginning of every lesson (and in their own time, too, if they wish). For example:

- Make as many positive integers as you can, using exactly 4 fours (and any mathematical operations).⁷
- How many squares are there on a chessboard?⁸
- How many ways are there to make $123456789 = 100$ true by inserting addition and/or subtraction signs between the digits on the left-hand side only?⁹

Once all the pupils have arrived for your lesson, an effective starter is needed to help them focus on learning, make them think and provide a sense of curiosity to maintain interest. The following tried and tested activities are particularly useful when it comes to engaging learners in maths lessons.

7 For example: $1 = (4 + 4) / (4 + 4)$; $2 = (4 / 4) + (4 / 4)$; $3 = (4 + 4 + 4) / 4$, etc.

8 There are 204.

9 There are 11. For example: $1 + 23 - 4 + 56 + 7 + 8 + 9 = 100$.

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is about much more than knowing the correct answers. Ian Loynd presents tried and tested strategies to maximise learning and to make maths enjoyable, engaging and comprehensible.

“The Perfect Maths Lesson is a concise guide to teaching maths and is full of interesting pedagogy and practical ideas. Whilst regularly referencing Ofsted, the mathematical learning that children undertake remains the focal point, as it should. Ian Loynd’s enthusiasm for the subject, and for teaching, comes across in abundance and all readers should close the back cover having taken away new ideas to implement in the classroom.”

Oliver Saunders, maths teacher, Millfield School

“This little book contains a wealth of good ideas, all of which can be modified and extended to use across different age ranges. It is a good mix of practical ideas to try in lessons and theory to improve teaching and learning.”

Beverley Dandy, Head Teacher, Outwoods Primary School

“If you’re looking for easily accessible ideas and strategies to refresh your teaching, whether in maths or other curriculum areas, this book will be an excellent addition to your collection.”

Paul Bannister, Head Teacher, Highbank Primary School

“Ian understands the need to bring the real world into the classroom, to give maths value and to engage learners so that they have a reason to show up. He provides pupils with stimulating real-life contexts that will challenge and prepare them, not make-believe contexts used simply to practise strategies or pass a test.”

Ruth Saxton, primary teacher and
Chair of the National Association for the Teaching of Drama

Ian Loynd, a maths teacher, school leader, governor, author, educational consultant and trainer, is also assistant head teacher at a large comprehensive school in Cardiff.

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