

How to explain \equiv absolutely anything to absolutely anyone

The Art & Science
of Teacher
Explanation

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To my son, George,
and to every other young person who just wants to know more.

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Contents

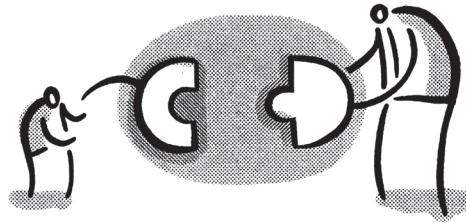
<i>Acknowledgements</i>	iv
Introduction	1
Chapter 1: Subject knowledge	11
Chapter 2: Credibility and clarity	29
Chapter 3: Explanation design	51
Chapter 4: Concepts, examples and misconceptions	75
Chapter 5: Metaphor and analogy	97
Chapter 6: Storytelling	115
Chapter 7: Elaboration	135
Conclusion: Getting better at explaining	155
<i>Bibliography</i>	167

Introduction

"Daddy, in football, is a striker the same as a forward?"

"Daddy, why do we have wars?"

"Daddy, what would happen if all books were made of bacon?"

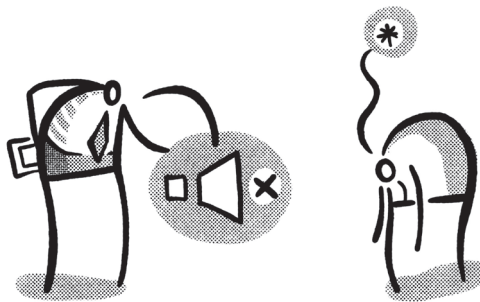


From the age of about two, children develop the intellectual ability to ask *why* questions. It is a vital developmental milestone. Their burgeoning curiosity about the world and their increasing proficiency with language means that they become desperate to learn more. To quench their new-found thirst for knowledge and understanding, they seek answers from the adults in their lives; their parents and teachers. They are becoming aware of what they do not yet know, or have not yet imagined, and they go on a tireless hunt for the further information and elaboration that might lift the veil on the mysteries of the universe. George, my 6-year-old son, asked me the three questions above over the period of time I spent writing this book. (Be assured, this book *is* suitable for vegetarians!)

Nothing could be more natural to human language and communication than explanation. Explanations have a range of purposes: to make something understandable; to clarify and expand an idea; to give the causes, context and consequences of a situation or event; or to show how facts and concepts are related and connected. The most straightforward definition of an explanation is 'the answer to a question'. As members of language communities, we provide and receive countless

explanations every day, at work and at play. This is why the word 'because' is one of the most important in the English lexicon. If the question is 'why', the explanation finds its origin in 'because'.

It is near impossible to conceive of effective teaching without explanation. A teacher who does not explain is little more than a mute babysitter. However, classroom explanations – also known as 'instructional explanations' – are more problematic than those that occur spontaneously in the course of ordinary life. This is because the recipients of the explanation, our students, have not previously sought out the new information that we require them to learn. Sometimes, they are not aware of what they do not know. More troublesomely, they sometimes hold misconceptions which mean that they are completely convinced of an alternative and inaccurate 'truth' to the one we hope they will learn. Sometimes the problem lies in a lack of motivation, especially when students fail to see the relevance of the new material that we are trying to explain.



It would seem sensible, then, to assume that if young people are to learn about the nuances of tectonic shift or the finer details of atomic structure, their teachers should learn how to explain these ideas with clarity, precision, flair and agility. It would also seem sensible that a sizeable portion of teacher training and development be dedicated to helping teachers to improve their ability to explain these concepts. Sadly, this could not be further from reality. In recent years, teacher talk – the most efficient form of explanation known to man – has become the black sheep of the education world. In some schools, teachers have been encouraged to talk less so that their students can talk more. Group-work and student-to-student discussion have become the gold standard, lauded and applauded despite their considerable limitations when students are working with new material. Teachers

have been discouraged from speaking for too long, and in some cases have been hung, drawn and quartered for doing so!

Thankfully, the tables are beginning to turn. Common sense and research evidence are converging to reassert the importance of the teacher's role in the classroom and, more significantly, the importance of the things that the teacher has to say. In 2014, teacher and writer Daisy Christodoulou's *Seven Myths About Education* methodically dismantled many prominent misconceptions about teaching and learning. In response to those who argue that teacher-led instruction is passive, Christodoulou wrote:

There is a reason why it took humans such a long time to discover the laws of nature, even though the evidence for such laws was all around them in the environment. We do not find it easy to learn new information when we have no or minimal guidance.¹

Each new generation stands on the shoulders of the last. Few young people can understand the theories of Charles Darwin and Albert Einstein, or fully appreciate William Shakespeare and Mary Shelley, without guidance and explanation from an expert teacher. It is essential that teachers feel confident enough to stand up at the front and teach such world-changing content without the accusation of being didactic or overly dominating. There is a time for teachers to talk; and there is a time for students to listen. Of course, there is also a time when the reverse is more desirable and students should be working independently and autonomously. But this should usually happen towards the end of a sequence of learning, not at the beginning. In most cases, teachers should first provide answers and then open the space for interrogation.

A wealth of empirical evidence supports the assertion that teacher explanations perform a crucial role in learning. Educationalist John Hattie systematically analyses the effectiveness of different influences on learning. At the time of writing, his most recent list of 252 separate influences placed 'teacher clarity' at a very significant number 24.² John Hattie and Gregory Yates have also shown that teaching is

1 Daisy Christodoulou, *Seven Myths About Education* [Kindle edn] (Abingdon: Routledge, 2014), loc. 1033.

2 See Sebastian Waack, Hattie Ranking: 252 Influences and Effect Sizes Related to Student Achievement, *Visible Learning*. Available at: <https://visible-learning.org/hattie-ranking-influences-effect-sizes-learning-achievement/>.

much more effective when teachers use methods that *activate* learning rather than methods that *facilitate* learning.³ Put simply, students usually learn better when a teacher introduces new content rather than attempts to elicit it from them. Moreover, evidence from cognitive science reveals that the less prior knowledge a student has about a topic, the more teacher guidance they need. Human cognitive architecture is simply not designed to learn difficult new concepts independently.⁴ Further evidence points towards the constructive influence of face-to-face interaction between teacher and student. For instance, one study shows that students' learning and persistence outcomes are better when they take in-person courses than when they take online courses.⁵

Needless to say, not all teacher talk is effective talk. Too often, simple concepts are made too complex and complex concepts too simple. Students can be left uninterested or overwhelmed. We must also stay vigilant against a pair of familiar adversaries: decreasing attention and wandering minds. Even though verbal explanations are a staple component of almost every lesson, it is also well-established that they do not always work for all students.⁶ However, this does not mean that teachers should limit their talk; it means instead that they should learn how to talk better. Explanations are to teaching what penicillin is to medical practice: essential but not effective in every case.

Research into effective teaching also reveals some fascinating and quite counterintuitive insights. In the US, Professor Siegfried Engelmann has compiled over half a century of evidence supporting Direct Instruction, a model of teaching that involves scripted explanations. Engelmann argues that what children learn is totally consistent with the input they receive from a teacher. Direct instruction involves precise clarity of wording, the use of carefully designed examples, and the teaching of rules and 'misrules' – all delivered through a systematic trickle of new information. Direct Instruction is a mastery approach to learning, which means that 85% of lesson time is devoted to practising material that children have

3 John Hattie and Gregory Yates, *Visible Learning and the Science of How We Learn* (Abingdon: Routledge, 2014), p. 73.

4 Paul A. Kirschner et al., Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching, *Educational Psychologist*, 41(2) (2006): 75–86.

5 Eric Bettinger and Susanna Loeb, Promises and Pitfalls of Online Education, *Evidence Speaks Reports* 2(15) (9 June 2017). Available at: <https://www.brookings.edu/research/promises-and-pitfalls-of-online-education/>.

6 See Jörg Wittwer and Alexander Renkl, Why Instructional Explanations Often Do Not Work: A Framework for Understanding the Effectiveness of Instructional Explanations, *Educational Psychologist* 43(1) (2008): 49–64.

already covered, while only 15% involves weaving in new material.⁷ A nine-year longitudinal study called Project Follow Through found that students who received Direct Instruction had significantly higher academic achievement, better problem-solving skills and higher self-confidence and self-esteem than students receiving any other type of instruction.⁸ Engelmann's slow and careful methods are a far cry from the rush and clamour of the way the curriculum is delivered in primary and secondary schools in England.

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Before we start to explore the how, let's take a moment to think about what we might be trying to achieve each time we launch into an explanation. Chris Anderson, the curator of the non-profit organisation TED, gives this advice to would-be public speakers: "Your number-one mission as a speaker is to take something that matters deeply to you and to rebuild it inside the minds of your listeners."⁹ This 'rebuilding' metaphor is essential to our understanding. The most effective explanations are designed and crafted with subtlety. As with the most robust physical structures, explanations should be built to last. The content we teach – whether it's quadratic equations or the respiratory system or dramatic irony – is not only for understanding and admiring now, but also for storing away for the future. A new fact, concept or idea is a gift for life, not a short-term loan.

There are many different types of instructional explanation. Teachers routinely explain facts, concepts, procedures, moral and aesthetic truths, metacognitive strategies and more. Each type of explanation comes with its own distinctive set of tricks and skills and a corresponding collection of hitches and hazards. We will explore these in full as we move through the book.

Explanation is an art form, albeit a slightly mysterious one. We know when we hear and see a teacher unravelling a great explanation. It has something to do with their effortless subject knowledge, the simplicity and directness of their language and the sense of assurance they exude. Nevertheless, we struggle to describe the intricacies of the craft. Just *how exactly* are they doing it? Invariably, we attribute good

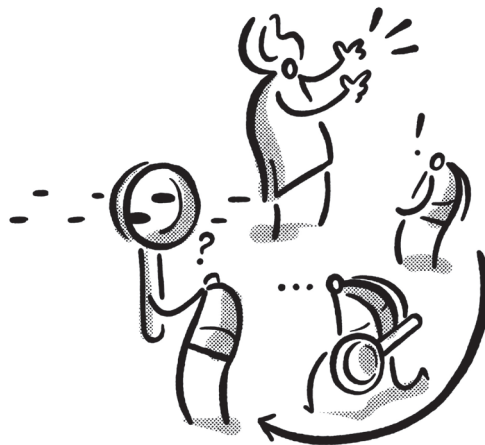
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7 See Shepard Barbash, *Clear Teaching: With Direct Instruction, Siegfried Engelmann Discovered a Better Way of Teaching* (Arlington, VA: Education Consumers Foundation, 2012).

8 See <https://www.nifdi.org/what-is-di/project-follow-through>.

9 Chris Anderson, *TED Talks: The Official TED Guide to Public Speaking* [Kindle edn] (New York: Houghton Mifflin Harcourt, 2016), loc. 262.

explanation to elements of a person's character or talents: "they're so confident" or "they explain things really clearly" or "they know their subject really well". However, these assumptions are unhelpful because they suggest that the ability to explain is a God-given gift; a form of tacit knowledge that some possess and others do not. In fact, explanation involves a set of intricate tools that anyone can master with a little patience and practice.



To unveil these hidden mysteries we will dip our toes into several forms of evidence. We will draw from educational research, from curriculum theory, from cognitive science, from the study of linguistics, from communication studies, from ancient philosophy and from the expertise of great teachers. We will look at how the most effective speakers, presenters and writers can transform even the most messy, complicated idea into a thing of wondrous crystalline clarity. And lastly, I will share some anecdotal accounts from my own English lessons of how I have attempted, often clumsily, to improve the way in which I explain new ideas in my classroom.

The idea of writing this book came to me on a rainy Saturday afternoon when I was halfway through the first chapter of Carlo Rovelli's *Seven Brief Lessons on Physics*.¹⁰ I had wanted to read a book about physics for a while; it is a subject I know very

¹⁰ Carlo Rovelli, *Seven Brief Lessons on Physics*, Simon Carnell and Eric Segre (trs) (London: Penguin, 2015).

little about and one that has always somewhat intimidated me. I was struck immediately by the way in which Rovelli welcomed me into this new and potentially hostile world. Suddenly, the theory of relativity – for so long the impenetrable playground of wiry-haired science types – was something that even I, in my limited way, could begin to grasp. But more than that, it was lucid, strange and enticing. Beautiful even. I wanted to find out more.

How did Rovelli paint this new world so vividly? Let's begin with his bluntly put first sentence: "In his youth Albert Einstein spent a year loafing aimlessly."¹¹ Immediately, Rovelli opens a gap between expectation and reality by disrupting our conventional beliefs about Einstein: he seems more like a conventional teenager than a prodigious genius-in-waiting. Rovelli then plants us in a very specific time and place: Italy at the turn of the nineteenth century. Success stories are driven by obstacles that stand in the way of the protagonist's goal, and Albert's story as it progresses is no different: "his theory of relativity did not fit with what we know about gravity, namely how things fall".¹² In fact, Einstein had found himself – theoretically at least – pitted against a titanic foe: Isaac Newton, the godfather of Western physics.

After framing his narrative, Rovelli pops himself into the story. He recounts the moment on a sunny beach in Calabria where, in the pages of a mouse-gnawed book, he finally appreciated the magnitude of Einstein's theory. Looking up from the book and out to sea, Rovelli envisaged "the curvature of space and time"¹³ as Einstein described it. This is an emotional and finely drawn epiphany – note the wonderful contrast between the tatty, nibbled book and the unimaginable greatness of the cosmos.

As he moves more deeply into scientific theory, Rovelli brings the mysteries of reality alive through metaphor. Space is described as a "gigantic flexible snail-shell", the earth as "a marble that rolls in a funnel". Other sentences are written with remarkable economy: "The gravitational field is not diffused through space; the gravitational field is that space itself".¹⁴

Rovelli's short chapter includes many of the tools vital to a great explanation: an interesting story; a clear context; an unsolved problem; a personal involvement; a

11 Rovelli, *Seven Brief Lessons on Physics*, p. 1.

12 Rovelli, *Seven Brief Lessons on Physics*, p. 2.

13 Rovelli, *Seven Brief Lessons on Physics*, p. 4.

14 Rovelli, *Seven Brief Lessons on Physics*, p. 6.

journey from the concrete to the abstract; the precise use of metaphor to capture hard-to-imagine concepts; and a vividness and economy of language. Teachers can certainly learn a lot about the art of explanation from reading books on complicated topics written for a lay audience, like Rovelli's.

Needless to say, skilful classroom explanation is about much more than word choice and the odd deft figure of speech. For example, students arrive in our classrooms with widely differing prior knowledge, which then influences how much they can comprehend and commit to memory. Furthermore, the language of many subjects, such as mathematics, goes far beyond spoken and written English. Images, diagrams, graphs and visual organisers are part and parcel of the symbolic code of learning. We should also be clear that explanations are *not* lectures. Ideally, they involve a dialogic process that involves active listening and participation from every person in the room.

A teacher's use of language also has a wider purpose: to induct students into the academic discourse of each subject. Think of each subject as having its own *grammar*; its own language world. This is a set of language conventions – involving phraseology, syntax, vocabulary and idiomatic expressions – that reflects the kind of thought processes inherent to the discipline and used with ease by subject experts. Consider the importance of conditional clauses – *if ... then* clauses – to scientific thinking: *if* you freeze water, *then* it becomes a solid. Or the way in which English literature relies on tentative and exploratory language: the poet *seems to hint* that power dissipates and fades with time. Only students from academic families are likely to already be familiar with these language worlds. Unless we actively and purposefully model the implicit grammar of our subjects, we will struggle to improve our students' thinking, speaking or writing. Think of yourself as a member of an exclusive language club. How will you equip all your students to get past the bouncers on the door so they can join you inside? This task is even harder for primary teachers, whose role it is to induct students into multiple subjects and multiple language worlds.

Good teacher talk also improves students' vocabulary. This is particularly relevant at the time of writing as the new knowledge-rich primary and secondary curriculums in England require students to acquire an ever-deeper knowledge of words. Unfortunately, one in five children in England join secondary school unable to

read to a standard that enables them to access the curriculum.¹⁵ Of 24 OECD countries, England is the only one where 16–24-year-olds have lower literacy skills than 55–65-year-olds.¹⁶ Knowledge of words and syntactical conventions (the arrangements of words and phrases in sentences) is not only vital to the development of reading competency, but also the key to unlocking academic success. A student will only build their vocabulary through regular and repeated exposure to new words, ideally through lots of reading. However, as only just over one-third of schoolchildren in England read at home every day, a teacher’s deliberate and targeted use of words can go some way towards providing this exposure.¹⁷

In the chapters that follow, we will explore seven key principles for explanation that apply to every subject, age group and educational phase. These are:

Chapter 1: Subject knowledge

Your subject knowledge is both your magic bullet and your Achilles heel.

Chapter 2: Credibility and clarity

All explanation is also an act of persuasion.

Chapter 3: Explanation design

Too much new information at once can reduce learning. Less is usually more.

Chapter 4: Concepts, examples and misconceptions

Abstract concepts should be supported by concrete examples.

Chapter 5: Metaphor and analogy

Connections should be forged between students’ prior knowledge and the material to be learnt.

Chapter 6: Storytelling

Your students are pre-wired to learn from storytelling.

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- 15 Department for Education, *Reading: The Next Steps: Supporting Higher Standards in Schools*. Ref: DFE-00094-2015 (London: Department for Education, 2015). Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/409409/Reading_the_next_steps.pdf, p. 13.
- 16 OECD, *Country Note: England and Northern Ireland (UK): Survey of Adult Skills First Results*. Available at: <http://www.oecd.org/skills/piaac/Country%20note%20-%20United%20Kingdom.pdf>, p. 4.
- 17 Liz Twist et al., *PIRLS 2011: Reading Achievement in England* (Slough: NFER, 2012). Available at: <https://www.nfer.ac.uk/publications/PRTZ01/PRTZ01.pdf>, p. 73.

Chapter 7: Elaboration

Explanations are only effective when students are also given the opportunity to think about the new material.

The conclusion explores ways in which you can hone and practise your explanations, and how to support other teachers in improving theirs.

Ultimately, the purpose of this book is to introduce and explain a series of concepts and processes that will help you to think differently about the way in which you introduce and explain new knowledge and skills. Each section also provides very simple and practical strategies that you can put into action straight away.

We will examine both the art and the science of explanation, and I will argue that to be most effective it requires a judicious blend of poetry and precision.

Let us begin.

Explanation is an art form, albeit a slightly mysterious one.

We know a great explanation when we see or hear one, yet nevertheless we struggle to pin down the intricacies of the craft.

Just *how exactly* is it done?

In *How to Explain Absolutely Anything to Absolutely Anyone*, Andy Tharby eloquently explores the art and science of this undervalued skill and talks you through a set of remarkably simple techniques designed to revolutionise the precision and clarity of your message.

Delving into the wonder of metaphor, the brilliance of repetition and the timeless benefits of storytelling, Andy sets out an evidence-informed approach that will enable you to explain tricky concepts so well that your students will not only understand them perfectly, but remember them forever too.

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Skilfully explores the importance of high-quality explanation and offers teachers clear guidance on what they can do better in order to achieve it.

Dr Brian Marsh, Principal Lecturer in Science Education, School of Education, University of Brighton

Tharby brings evidence and intelligence to bear in order to reveal, in intricate detail, what makes for powerful teacher explanations.

Alex Quigley, Senior Associate, Education Endowment Foundation and author of *Closing the Vocabulary Gap*

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Mary Myatt, education adviser, writer and author of *Curriculum: Gallimaufry to Coherence*

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Ross Morrison McGill @TeacherToolkit – the UK's most followed educator on Twitter, who writes at TeacherToolkit.co.uk

Rooted in research, Andy's captivating and persuasive arguments are bolstered by his practical experience and carefully considered reflections.

Jill Berry, leadership consultant and former head teacher

Andy Tharby is a practising English teacher with over a decade's classroom experience at a secondary school in West Sussex. He is co-author of the award-winning *Making Every Lesson Count* and the author of *Making Every English Lesson Count*. Andy is also interested in helping fellow teachers enhance their practice through engagement with research evidence.



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