FEATURING:

An interview with Daniel Willingham

Comparative judgement
The next big revolution in assessment?

Research that changed my teaching

Myth-busting
Learning styles

The psychology of habits

Teaching Re▲thought.
Teaching Re●taught.

The **Institute for Teaching** is a specialist graduate school for teachers. Our courses have a single purpose - to help teachers to keep getting better.

Teacher
Masters in Expert Teaching

- Part time course designed for busy teachers (2 years)

- Grounded in transformational teaching practices from around the world

- Practical application in *your classroom* - measures improvements in pupil outcomes

- A dedicated personal expert coach

- Access to a community of like-minded education professionals

Teacher Educator
Fellowship in Teacher Education

- Part time course designed for teacher educators

- Access to curated teacher development and adult learning research

- Develop *informed and intentional* approaches to key components of teacher education

- A dedicated personal expert coach

- Access to a community of like-minded education professionals

Having an expert teacher in every classroom is the best way to make sure that every pupil, regardless of their background, gets a great education.

But teaching is complex – becoming an expert isn't easy. To improve teaching we must improve teacher training. Teachers deserve as much effort to go into their training as they put into their teaching.

That's why we are doing things differently. Re-thinking teacher education and providing a pathway towards expertise, taught by our faculty of world class teacher educators.

What is Expert Teaching?

We've studied experts in 'performance professions' from surgeons to elite athletes. Expertise in these disciplines demands rigour and fluency.

Teaching is no different.

Getting better is no small feat, and teachers need to focus on doing one thing that no-one else can: figuring out how the research applies to their classroom.

Course Design

Our courses are grounded in the latest research and best practice. Our faculty have taught and researched all over the world.

We've incorporated this experience and research into our practice based courses that help teachers to think differently and act differently.

Our courses are challenging, but also designed to align with the lives of busy teachers.

CONTENTS

FROM THE EDITOR

Welcome to the first issue of *researchED* magazine!

Brain Gym. Learning styles. NLP. I started teaching in the early 2000s in what now seems like a golden age of edu-babble, where anyone could apparently claim anything and nobody could say otherwise. researchED started as a one-day conference in 2014, born out of a frustration I felt that teaching, and education more broadly, frequently failed to use evidence as much as it should. It seems that others also shared that frustration, but also a deeply felt belief that it was time to change things for the better. One conference became dozens, and the idea leapt from East London to the world. We now hold events everywhere from New Zealand to Philadelphia, bringing together teachers, academics, researchers, leaders and anyone else involved in the education ecosystem. We've been proud to host some of the most important voices in education, as well as platform many of the hidden heroes of the classroom.

Our aims have stayed the same since we began:

1. To bust the myths and bad science that grip education and wreck the life chances of children everywhere
2. To platform evidence bases that make a difference in classrooms and schools
3. To raise research literacy in the teaching profession
4. To bring research-generators and research-users closer together in mutually beneficial dialogue
5. To build an international community of evidence-informed educators

Launching this magazine is the next stage in making these happen. The original idea was to capture the ideas, the excitement, and the passion for reason of a researchED conference in a resource that could be read, shared, and read again, passed around staffrooms and pinned, in cannibalised form, to classroom walls. Inside you'll find expert opinion, summaries of what we think works best (or doesn't), provocations, great ideas, and best of all, how this might translate into the classroom.

People talk about 21st century teaching. I don't think we're even in the 20th century yet. We still see edu-homeopathy passed off as cure-alls, and ideas from the 19th century dressed as cutting-edge innovations. Teachers still forced to carry out decisions that originate more in ideology than in reason and research. Children – and professionals, and society – can no longer afford such indulgences. It is time for a polite revolution in education. One that doesn't require us to wait for Superman or seek permission from others. Educators of all stripes can now take part in this international and democratic conversation to seek out what works, what doesn't, and when, and how, in their schools and classrooms. It's time to apply evidence to the craft of teaching, and craft to that evidence, and see what happens in the beautiful space where they overlap.

I think it's a very exciting time to be in education. And there has rarely been so important a project. I hope you enjoy the magazine – and maybe we'll see you at one of our conferences!

Best wishes,

Tom Bennett
Editor
Founder of researchED
London, 2018

CONTRIBUTORS
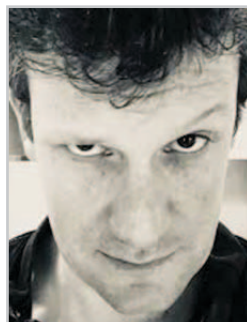
Greg Ashman

Greg Ashman is Head of Mathematics at Ballarat Clarendon College, a regional school in Victoria, Australia, and a PhD candidate investigating cognitive load theory. He can be found on Twitter correcting people at @greg_ashman

Dr Jennifer Buckingham

Dr Jennifer Buckingham is a senior research fellow and director of the FIVE From FIVE reading project at the Centre for Independent Studies in Australia.

Professor Daniel Willingham

Professor Daniel Willingham is Professor of Psychology at the University of Virginia, US, and author of the bestselling *Why Don't Students Like School?* In 2017 he was appointed by President Obama to serve as a Member of the National Board for Education Sciences.

Daisy Christodoulou

Daisy Christodoulou is the Director of Education at No More Marking, a provider of online comparative judgement, and the author of *Seven Myths about Education*. A polymath, her other specialist subjects are football and the arthouse series of *Carry On* films.

Dr Pedro De Bruyckere

Dr Pedro De Bruyckere has been an educational scientist at Arteveldehogeschool in Ghent, Belgium, since 2001. One of his best points is that he is funny when explaining serious stuff. He is on Twitter at @thebandb

Carl Hendrick

Carl Hendrick is Head of Research at Wellington College, UK, and a PhD candidate at KCL. In a previous life Carl was in a rock band, leaving both the fields of education and entertainment wondering which is the more bereft by his absence.

Joe Kirby

Joe Kirby is a Deputy Head with the Inspiration Trust, and one of the UK's top teacher-bloggers in recent years.

Professor Paul Kirschner

Professor Paul Kirschner is an educational realist and Distinguished University Professor in Educational Psychology at the Open Universiteit in the Netherlands.

Professor Daniel Muijs

Professor Daniel Muijs is Head of Research at Ofsted and visiting professor at the University of Southampton, UK.

Hélène Galdin-O'Shea

Hélène Galdin-O'Shea is an English and media teacher, and co-founder of researchED.

Ben Riley

Ben Riley is founder of Deans for Impact, a national organisation dedicated to transforming the way educators are prepared in the US.

Tom Sherrington

Tom Sherrington is a former headteacher and now works as a consultant and speaker. His latest book is *The Learning Rainforest*.
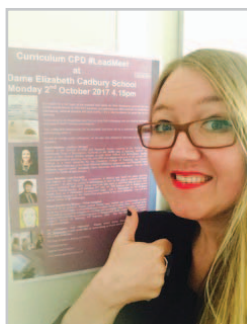
Claire Stoneman

Claire Stoneman is a deputy headteacher and English teacher, writer, opera singer. She was proudly Made in Brum.

Charis Anderson

Charis Anderson is Director of Communications at Deans for Impact. Also: former reporter, sometime swim coach and semi-motivated runner.

TOM BENNETT SPEAKS TO...

PROFESSOR DANIEL WILLINGHAM

Professor Daniel Willingham is currently Professor of Psychology at the University of Virginia, where he has taught since 1992. Until about 2000, his research focused solely on the brain basis of learning and memory. Today, all of his research concerns the application of cognitive psychology to primary/secondary education.

He writes the 'Ask the Cognitive Scientist' column for *American Educator* magazine and is the author of *Why Don't Students Like School?*, *When Can You Trust The Experts?*, *Raising Kids Who Read* and *The Reading Mind*. His writing on education has appeared in 16 languages.

In 2017 he was appointed by President Obama to serve as a Member of the National Board for Education Sciences.

Written by one of the most important figures in the recent international explosion of interest in evidence-informed education, Professor Daniel Willingham's book *Why Don't Students Like School?* is a rarity in its field – a book about research that is accessible to teachers but doesn't talk down to them. It also deservedly and routinely hovers around the top spot in sales charts for educational training books, even though it first came out in 2010. We were fortunate enough to speak to Professor Willingham in February 2018 about his thoughts on learning, growth mindset, teacher training, learning styles…and *The Karate Kid*.

Tom Bennett: One thing I'm often told by teachers is 'I'd like to know more about using evidence from psychology in the classroom, but I don't have enough time.' What are the key messages from *Why Don't Students Like School?*

Professor Daniel Willingham: That there is useful information coming from science that will complement your knowledge that you've gained teaching. And that there are many things IT can't help with, and some things people claim science can help with that I don't think it can. There are a small number of things we know something about and when we do, that's useful, and that's worth sharing. And that's the overarching point of the book. Each of the chapters is essentially one such nugget. So, these are the things I think it's worth teachers knowing, coming from cognitive science. And this is a point further elaborated in the book that came after (*When Can You Trust The Experts?*, 2012, Jossey-Bass): even when there's something that scientists know with confidence that teachers should know, the classroom application is still tricky. It certainly doesn't mean scientists can tell teachers, 'Well that means you ought to be doing this.' It means that any conclusions that are drawn need to be tentative and they need to be thoughtful and it needs to be run through the filter of what teachers know about their

classroom, their practice, and other aspects of the context within which they teach.

TB: Some people say there's a danger evidence can disempower teachers, i.e., 'You MUST teach this way.'

DW: I absolutely agree, and it's a big part of why I wrote *WCYTTE*. I was encountering so many frustrated teachers because research evidence was being used the way you described. I usually describe it as a cudgel used by administrators to say 'You need to be doing this because all the research evidence supports it.' The analogy I drew from in the book is that people often think of the relationship between research and practice in education as being quite similar to medicine. And in medicine we see it as quite prescriptive – there are right ways and wrong ways to treat people for particular diseases and if you don't use the right way you're guilty of malpractice. My friends who are physicians tell me that's actually less the case than you think and of course you can do terrible things and be guilty of malpractice but usually there's usually a little more slop in it than you might think – and I always think to myself 'You ought to see *my* practice!'

That said, I think there are instances of things we know for particular aspects of education that, if you don't respect that principle then you're probably going to have a pretty hard time achieving your stated goal. I called these boundary conditions and the analogy I drew was not with medicine but with architecture. If you're building a skyscraper, there are principles of physics you're just going to need to respect, principles of science that if you don't, your building is going to fall down. Likewise, there are a few principles that you need to respect in teaching; so one, for example, is practice. If you think that someone is going to reach proficiency in a task without practising, I don't see how that's possible. But the point of the analogy with architecture is that the principles of physics don't tell you how to build the skyscraper or what it needs to look like. That's why I call them boundary conditions. But within the boundaries there are enormous variations that are possible. But you do have to be aware of and respect those boundaries to reach your goal.

TB: What's the most important takeaway for teacher training?

DW: The principle that memory is the residue of thought. Everybody appreciates that without attention there is no learning. And if children aren't paying attention then they're not going to learn anything from the lesson. And the idea is that 'memory really depends on what you think about' is so obvious once it's articulated, but it's something that a lot of people hadn't thought about, and I think it is as important as the idea that 'without attention there is no learning' for more or less the same reason. Whatever children are thinking about is essentially what they're paying attention to and that's what they're going to remember.

TB: Your second book, *WCYTTE* – what inspired that?

DW: The driving point behind that was frustration on the part of teachers being asked to change classroom practice in the name of research – research that they weren't confident was really as solid as was being presented to

them. But at the same time they didn't feel they were in a position to evaluate – much less challenge – the research so I tried to write a book that would help someone who was not a researcher evaluate research.

TB: Do you think teachers are interested in challenging their paradigms?

DW: I think it's a very individual thing. It's not why you get into the field. We do have a lot of data on this. Most teachers become teachers because they like children and because they want to make a difference in the world. So, struggling with your assistant principal over your practice is not something that you really foresaw doing when you got into the field. So, it's not something you relish. That might be behind why *WCYTTE* was not a huge success… you don't really want to have to work on it, you'd much rather the problem went away. And the truth of it is that in many cases it does. The assistant principal moves on; they move on to another job or find something else.

TB: On that note, without a background in psychology, how can teachers know what ideas they should trust?

DW: That's a very difficult problem. I wrote this book with the idea that I didn't think it would be useful to write a one-book short course on how to be a researcher. That seemed hopeless to me. So, I tried to write something that was a bit of a cheat, where you're not exactly evaluating the research but you're doing things that are associated with high-quality research versus bad research. So yeah, I think it's an enormously difficult problem. And of course, the great irony is that what would be really interesting and persuasive to do would be to have 100 teachers read my book and have 100 teachers read some other book and then give them all problems, actually put my money where my mouth is and do some research on my methods [laughs]. I didn't do that and don't intend to.

TB: In *The Science of Learning* for Deans for Impact [an influential summary of useful cognitive psychology applied to the classroom, co-designed by Professor Willingham], we read the idea that subject areas each have some set of facts that, if committed to memory, aids problem solving. Can you expand?

DW: In that context we were talking about knowledge of that subject. We were saying, domain by domain, there are different sets of facts, and you need to know them in different ways. Maths offers a great example; maths facts really ought to be known to a great level of automaticity, but other types of information don't need to be learned to automaticity.

TB: In the UK there is currently a long debate about need for children to memorise multiplication tables, and a variety of arguments against it. 'Why up to 12? We have calculators. It's harmful/kills their love of mathematics…' etc.

DW: I find [this] very puzzling. There's an enormous amount of research indicating that students that don't memorise maths facts have a much harder time with mathematics further down the line. That work started in the '60s and '70s, and by the time the US National Maths Panel issued its report in 2008 there was really a great deal of evidence that they were able to draw on, so I find that

> I think growth mindset is a wonderful idea, but it's something that can be over sold and people can over rely on.

report very useful, and I hope it's part of the debate in the UK. I don't think there's much question that kids succeed in mathematics at a much higher rate if they memorise maths facts as part of the curriculum. In terms of it being boring: it certainly has the potential to be boring and I think that making it interesting and fun is challenging because it's so repetitive – doing things to the point of automaticity is going to be repetitive. So yeah, that requires ingenuity and creativity on the part of the teachers. It doesn't strike me as inevitable that it's going to be a miserable experience and it's going to kill the love of mathematics. I think many teachers would know better than I would how you make this sort of thing more fun and interesting.

TB: I call this the Mr Miyagi *Karate Kid* Principle: wax on, wax off…

DW: Although the Karate Kid was pretty miserable; I don't know that I would want to use that as my model. 'Paint the fence.' [laughs]

TB: I'm sure karate instructors everywhere rarely use any other technique. Moving on. There's an argument that getting children to sit tests is harmful to them. Do you have any comment?

DW: Yeah – I would say that if there's a child that is enormously anxious about a test then two things immediately come to my mind. One is: what has this child heard about this test? What has someone said to the child about the consequences of their performance on this test, and is that promoting this anxiety? And the second thing is that if the answer to the first question is 'Not much, we just said we're all going to practise some maths problems, and on Friday we all want you to do your best,' whatever, when it's all been pretty low key and the child is still anxious, then someone needs to talk to that child and find out why they're still so anxious about something that none of the other children are anxious about. This to me is like boredom practising times tables – tests certainly have the potential to create anxiety, but it's not inevitable.

TB: Some teachers argue learning about grit, growth mindset etc. are more important than learning about memory. Why is understanding about memory more important as a part of a teacher's mental model?

DW: Sure. First I would point out that focusing on grit strikes me as something that has the potential to go wrong. In more than one way, but I'll focus on one way. One of

the important problems is that people remember the determination parts about grit but they forget the passion parts about grit. When people talk about focusing on grit, I actually think it's a wonderful idea in classrooms, but I also want to remind them you don't get to pick what the child is gritty about. This is supposed to be about a long-term goal that the child is supposed to be passionate about. You're not going to make every child gritty about some academic concept. Now, the idea of some children going to a school where the faculty encouraged them to figure out what they're really passionate about and to encourage that – I love that idea. But if my child says I feel gritty about ants, or ballet, or the New York Yankees, I want my school to be equally encouraging about all of that and not say 'No, what you're really supposed to be gritty about is maths'. That's counter to what grit is all about.

TB: Are you suggesting it's not transferable?

DW: Oh of course it's not. It's central to the idea that it's not transferable. I think growth mindset is another idea that is a wonderful idea and ought to be encouraged, but it's something that can be over sold and people can over rely on. I'm sure I don't need to tell you – Carol Dweck wrote an op-ed in *Education Week* about a year ago saying 'Everyone is screwing this up, everyone's missing the point about growth mindset, and getting it wrong in schools'. So you do want to make sure that you're talking to children about growth mindset in the way that there's really some research indicating it's a useful way to talk about it. And I think Carol's interpretation of ways that it can go wrong is very consistent with her theories and other theories of motivation. So to get back to your question 'Why teach children about memory, couldn't you just teach them about growth mindset?'… Growth mindset is of course about getting kids to take responsibility and to feel capable in terms of learning and teaching themselves things, and the reason to teach them about memory is, once they've got the motivation to do that it will make achieving that much easier. If you know how your memory works then you can get things into memory and use your memory much more efficiently.

TB: Whenever I speak to teachers at researchED about memory, many teachers say to me 'Why didn't we learn about this in teacher training?' It's a good question. Back to reading, another contested and controversial field. What are your key messages about how teachers should be teaching children to read?

DW: I just published a book, *The Reading Mind,* but it's not really a book about teaching reading. It's a book about what's happening in the mind of someone who knows how to read. And I specifically didn't write a book about how to teach reading. It's a different and very complex literature. And that was a task I didn't want to tackle. I will say that during our conversation, early on I said there were certain principles that if you didn't respect them, you were probably going to have a very hard time. We keep bumping up against them in the conversation. One of them is 'If you don't teach children maths facts it's going to be a whole lot harder to teach them mathematics'. And another one is 'For at least some children, teaching what's usually called phonics is really important for reading.' There are some

kids where explicit instruction probably helps a little bit, but they've got so many other things cognitively in place that with minimal assistance in the phonics realm they're going to be just fine, and then there are other kids where phonics instruction is enormously important.

TB: What is your next book going to be about?

DW: My next book is going to be about self-regulated learning. It's focused on the idea that when children first arrive in school, our expectation that they can take any responsibility for their learning is zero. And obviously appropriately so. If a pre-schooler doesn't learn anything we don't blame the pre-schooler, we blame the teacher, not setting up good circumstances where the child can learn something. By the time children are finishing school at age 18 or so our expectations are very high, and we expect that we can give them complex texts and they will know how to read those texts, and they will be resourceful if they find those texts confusing, and they will know how to study for an examination. And most American kids have had no instruction in how to do those things. And instead they have figured out on their own, they have come up with their own strategies.

And how to commit things to memory, how to read a difficult text. So that's what this book is about. We know that there are a number of studies of college students in the US about how they do these tasks, and we find that they come up with strategies on their own, but these strategies are usually not very effective.

TB: What are your thoughts on cognitive load theory?

DW: I think CLT is quite useful, and consistent with a lot of data.

TB: Short and sweet.

DW: It's a quite specific theory and it generates a lot of predications and there's quite a lot of research literature that's grown up around it, and so it for that reason it's complex to get into it, and for that reason… I think it's quite a successful theory.

TB: I know you've been doing some work on teacher training recently. Can you tell me anything about that?

DW: Yes I've got a couple of articles on this. It's really one idea. The central question and idea is 'Why have I had any success doing what I've been doing for the last 10 or 15 years?' That was very much my reaction in one article that I hope is going to appear in *Education Week* – an open access journal – in the near future. I open this article with my experience of the very first time I spoke to teachers when I was still strictly a memory researcher, I had never done anything with education. And I was invited to give a talk to 500 teachers. And I said 'This is a terrible idea, I don't know anything about classrooms.' They said, 'We get that; we just want you to talk about cognitive psychology. We think our teachers would be interested,' so I rashly agreed to do this. And six months later, it was just about time for me to give the talk – I was about two weeks out – and I panicked and I realised 'what in the world am I going to say to teachers about cognitive psychology that they don't already know?' I literally just walked in from the introductory cog course that I teach at college to sophomores and I was guessing that some of it was relevant to what they wanted to know

about, but I was utterly certain I was going to be telling them things they already knew. To my astonishment they liked it. They didn't know it and they thought it was interesting. So that's the question: how is it possible that teachers don't know the principles of how people think? That's something I teach in the very first course in that subject if you study cognitive psychology at college. In the paper I offer some answers to why I think this is happening. I think teachers actually are introduced to that topic – I can't speak for the UK, but in the States, I think they are exposed to that content, but they are also exposed to a lot of other content of very low utility.

[nb: if you're interested in hearing Professor Willingham's thoughts on this, go to soundcloud.com/voiced-radio/researched-ontario-keynote-dan-willingham and hear his keynote speech from researchED Ontario, April 14th 2018]

TB: OK, and finally, back to a topic that seems to exemplify the challenges facing us when we try to build an evidence-informed education system. Despite all the evidence against it, why does belief in learning styles endure?

DW: I think learning styles have reached the status where people wouldn't think to question it. There's a whole lot of things I believe for which I do not know the evidence; I just assume. The usual example I use is atomic theory. How do you know there really are atoms? I don't know – I would be like, 'They figured that out, right?' I couldn't tell you what the evidence is – everybody knows that the atomic theory is right. I think learning styles has actually reached that status, where people just assume that it's right. And your question is more broad than that – other beliefs also lack a research basis, but they're not as pervasive as learning styles. I'm not sure. I think there are a couple of reasons. One is there really isn't any authority in education the way there are in some other fields. Usually authorities are generated by practitioners. So, you get something like the American Medical Association, which is an organisation of practitioners and carries a lot of authority in terms of evaluation of health practices. If something new comes out, newspapers will call representatives of the AMA and ask what they think of it. There's not anything similar in education. And I think that's really a shame, it ought to be practitioner-led, this effort to cleanse the field of bad practice. And this one of the reasons I was so excited by researchED and was happy to support it in all ways that I can. It strikes me as serving a need that I've seen, and just doing a wonderful job.

To read more by Daniel Willingham, visit www.danielwillingham.com, where you will find many of his most popular articles for free. His 'Ask the Cognitive Scientist' column regularly appears in the journal *American Educator*.

INQUIRY LEARNING ISN'T – A CALL FOR DIRECT EXPLICIT INSTRUCTION[1]

Paul Kirschner

In 2006 Paul Kirschner published, with John Sweller and Richard E Clark, a now-seminal piece of research that threatened to blow the doors off an often-accepted orthodoxy in teaching: that students learn best when they discover things by themselves. They proposed that not only was this not the case, but that the best learning frequently took place when guided direct instruction by an expert was the main strategy.

In 2004/2005 John Sweller and I came up with a plan to write an article on why inquiry learning doesn't work (my original cryptic title was 'Inquiry Learning Isn't'); John, the sober scientist that he is, rejected that title. At a certain point we asked Dick Clark to act as a critical reader which ended up with him becoming the perfect third author. KSC, as we are often called, was born. Here's an impossible attempt to whittle that article down to 2000 understandable words.

At the turn of the century, sparked by the surge of what can be called constructivist pedagogies, the use and impact of instructional guidance in education was highly disputed.

KSC (see figure below, left) objected to this and rejected the (often implicit) argument underlying this thinking, namely that all people – novices and experts alike – learn best in an unguided or minimally guided environment. In such 'highly motivating' environments, learners, rather than being presented with essential information, must discover or construct essential information for themselves. We took the position that ideal learning environments for experts and novices differ because experts and novices differ (see figure below, right). While experts often thrive without much guidance, nearly everyone else thrives when provided direct instructional support and guidance.

Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching

Paul A. Kirschner
Educational Technology Expertise Center
Open University of the Netherlands
Research Centre Learning in Interaction
Utrecht University, The Netherlands

John Sweller
School of Education
University of New South Wales

Richard E. Clark
Rossier School of Education
University of Southern California

Experts

- Possess schemas for encoding elements into a single entity
- Skills acquisition without needing to recall the rule
- Automation important for complex problem-solving transfer
- Work forwards

Novices

- No access to relevant schemas
- Attempt to remember & process individual elements
- Need to apply cognitive capacity to inefficient problem-solving
- Work backwards

(Chi *et al.* 1982; DeGroot; 1965; Wilson & Cole, 1996; Schneider & Shiffrin, 1997; Kalyuga, Chandler & Sweller, 1998)

Decades of research demonstrates that for novices (the state of most students), direct explicit instruction is more effective and efficient – and in the long run enjoyable – than minimal guidance. So, when teaching new content and skills to novices, teachers are more effective when they provide explicit support and guidance. Direct, explicit instruction *fully explains* the concepts and skills that students are required to learn. It can be provided through all types of media and pedagogies (e.g., lectures, modelling, videos, computer-based presentations, demonstrations, class discussions, hands-on activities etc.) as long as the teacher ensures that the relevant information is explicitly provided and practised. Minimal instructional guidance, on the other hand, expects students to discover on their own most, if not all, of the concepts and skills they are supposed to learn. This approach has been given various names such as discovery learning, problem-based learning, inquiry learning, experiential learning, and constructivist learning.

Rich Mayer examined studies conducted from 1950 to the late 1980s that compared discovery learning (defined as unguided, problem-based instruction) with guided forms of instruction. In his famous three-strikes paper,[2] he suggested that in each decade since the mid-1950s, after empirical studies provided solid evidence that the then-popular form of unguided approach did not work, a similar approach soon popped up under a different name with the cycle then repeating itself. This pattern produced discovery learning, then experiential learning, then problem-based and inquiry learning, then constructivist pedagogies, *ad infinitum*. He concluded that the 'debate about discovery has been replayed many times in education but each time, the evidence has favored a guided approach to learning' (p. 18).

Evidence from well-designed, properly controlled experimental studies as well as classroom studies from the 1980s to today also supports direct instructional guidance. The research has shown that when students try to learn with discovery methods or with minimal feedback, they often become lost and frustrated, and their confusion can lead to misconceptions: That because false starts (where students pursue misguided hypotheses) are common, unguided discovery is also inefficient. In a very important study,[3] researchers not only tested whether science learners learned more via a discovery versus direct- instruction route but also, once learning had occurred, whether the quality of learning differed. The findings were unambiguous. Direct instruction involving considerable guidance, including examples, resulted in vastly more learning than discovery. Those relatively few students who learned via discovery showed no signs of superior quality of learning or superior transfer. Also, even if a problem or project is devised that all students succeed in completing, minimally guided instruction is much less efficient than explicit guidance. What can be taught directly in a 25-minute demonstration and discussion followed by 15 minutes of independent practice with good teacher feedback may take several class periods to learn via minimally guided projects and/or problem solving. And finally, *minimally guided instruction can increase the achievement gap*. A review of approximately 70 studies[4] found not only that higher skilled learners tend to learn more with less guided instruction, while lower skilled learners tend to learn more with more guided instruction, but that lower skilled students who used less guided instruction received significantly lower scores on post-tests than on pre-test measures. For these relatively weak students, the failure to provide strong instructional support and guidance produced a measurable loss of learning.

Now let's look at *how* we learn. There are two essential components that influence how we learn: long-term memory (LTM) and working memory (WM; often called short-term memory). LTM is a big mental warehouse of things while WM is a limited mental 'space' in which we think. However, to dispel a common misconception, LTM is not a passive repository of discrete, isolated fragments of information that permit us to repeat what we have learned, having only peripheral influence on complex cognitive processes such as critical thinking and problem solving. It is, rather, the central, dominant structure of human cognition. Everything we see, hear, and think about depends on and is influenced by our LTM. Expert problem solvers, for example, derive their skill by drawing on the extensive experience stored in their LTM in the form of concepts and procedures, known as mental schemas. They retrieve memories of past procedures and solutions, and then quickly select and apply the best ones for solving problems. We are skilful in an area if our LTM contains huge amounts of information concerning the area. That information permits us to quickly recognise the characteristics of a situation and indicates to us, often immediately and unconsciously, what to do and when to do it. And what are the instructional consequences of LTM? First and foremost, LTM provides us with the ultimate justification for instruction: the aim of all instruction is to add knowledge and skills to LTM. If nothing has been added to LTM, nothing has been learned.

WM, in contrast, is the cognitive structure in which conscious processing occurs. We are only conscious of the information currently being processed in WM and are more or less oblivious to the far larger amount of information stored in LTM. When processing novel information, WM is very limited in duration and capacity. We have known at least since the 1950s that almost all information stored in WM is lost within 30 seconds if it is not rehearsed and that the capacity of WM is limited to only a very small number of elements, estimated at about 7, but may be as low as 4 ± 1.

For instruction, the interactions between WM and LTM may be even more important than the processing limitations. The limitations of WM only apply to new, to-be-learned information (i.e., information that has not yet been stored in LTM). When dealing with previously learned information stored in LTM, these limitations disappear. Since information can be brought back from LTM to WM as needed, the 30-second limit of WM becomes irrelevant. Similarly, there are no known limits to the amount of such information that can be brought into WM from LTM.

These two facts – that WM is very limited when dealing with novel information, but is not limited when dealing with information stored in LTM – explain why minimally guided instruction typically is ineffective for novices, but can be effective for experts. When given a problem to solve, novices' only resource is their very constrained WM while experts have both their WM and all the relevant knowledge and skill stored in LTM.

One of the best examples of an instructional approach that takes into account how our working and long-term memories interact is the 'worked example effect'. Solving a problem requires searching for a solution, which must occur using our limited WM. If the learner has no relevant concepts or procedures in LTM, the only thing they can do is blindly search for possible solution steps that bridge the gap between the problem and its solution. This process places a great burden on WM capacity because the problem solver has to continually hold and process the current problem state in WM (e.g., Where am I right now in the problem solving process? How far have I come towards finding a solution?) along with the goal state (e.g., Where do I have to go? What is the solution?), the relations between the goal state and the problem state (e.g., Is this a good step toward solving the problem? Has what I've done helped me get nearer to where I need to go?), the solution steps that could further reduce the differences between the two states (e.g., What should the next step be? Will that step bring me closer to the solution? Is there another solution strategy that I can use that might be better?), and any sub goals along the way. Thus, searching for a solution overburdens limited WM and diverts working-memory resources away from storing information in LTM. As a consequence, novices can engage in problem-solving activities for extended periods and learn almost nothing.

In contrast, studying worked examples reduces the burden on WM (because the solution only has to be comprehended, not discovered) and directs attention (i.e., directs WM resources) toward storing the essential relations between problem-solving moves in LTM. Students learn to recognise which moves are required for particular problems, which is the basis for developing knowledge and skill as a problem solver. As the learner progresses, various steps can be faded away so that the learner needs to think up and complete those steps themself (partially worked examples).

It is important to note that this discussion of worked examples applies to novices – not experts. In fact, the worked-example effect first disappears and then reverses as the learners' expertise increases. That is, for experts with lots of knowledge in the LTM, solving a problem can be more effective than studying a worked example.

Why then, with all of this proof, do people continue to think that inquiry-based learning works? Turning back to Mayer's review of the literature, educators seem to confuse constructivism as a theory of how one learns and sees the world, and constructivism as a prescription for how to teach. In cognitive science, 'constructivism' is a widely accepted theory of learning; it claims that learners must construct mental representations of the world by engaging in active cognitive processing (i.e., schema construction). Many educators (unfortunately including professors in colleges of education) have latched on to this notion of students having to 'construct' their own knowledge and assume that the best way to promote such construction is to have students discover new knowledge or solve new problems without much guidance from the teacher. Unfortunately, this assumption is both widespread and incorrect. Mayer calls it the 'constructivist teaching fallacy'. Simply put, cognitive activity can happen with or without behavioural activity, and behavioural activity does not in any way guarantee cognitive activity. In fact, the type of active cognitive processing that students need to engage in to 'construct' knowledge can happen through reading a book, listening to a lecture, watching a teacher conduct an experiment while simultaneously describing what he or she is doing, etc. Learning requires the construction of knowledge. Construction is not facilitated by withholding information from students.

After a half-century of advocacy associated with instruction using minimal guidance, it appears that there is no body of sound research that supports using the technique with anyone other than the most expert students. Evidence from controlled, experimental (AKA 'gold standard') studies almost uniformly supports direct instructional guidance rather than minimal guidance for novice to intermediate learners. These findings and their associated theories suggest teachers should provide their students with clear, explicit instruction rather than merely assisting students in attempting to discover knowledge themselves.

1 This is a condensed version of the article 'The case for direct, explicit instruction' written for *American Educator* by the original authors which itself summarised parts of the original article 'Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching' by Kirschner, P. A., Sweller, J. and Clark, R. E., originally published in *Educational Psychologist* 41 (2) pp. 75–86.

2 Mayer, R. (2004) 'Should there be a three-strikes rule against pure discovery learning? The case for guided methods of instruction', *American Psychologist*, 59 (1) pp. 14–19.

3 Klahr, D. and Nigam, M. (2004) 'The equivalence of learning paths in early science instruction: effects of direct instruction and discovery learning', *Psychological Science* 15 (10) pp. 661–667.

4 Clark, R. E. (1989) 'When teaching kills learning: research on mathemathantics' in Mandl, H., Bennett, N., De Corte, E. and Friedrich, H. (eds) *Learning and instruction: European research in an international context, volume 2.* London, UK: Pergamon, pp. 1–22.
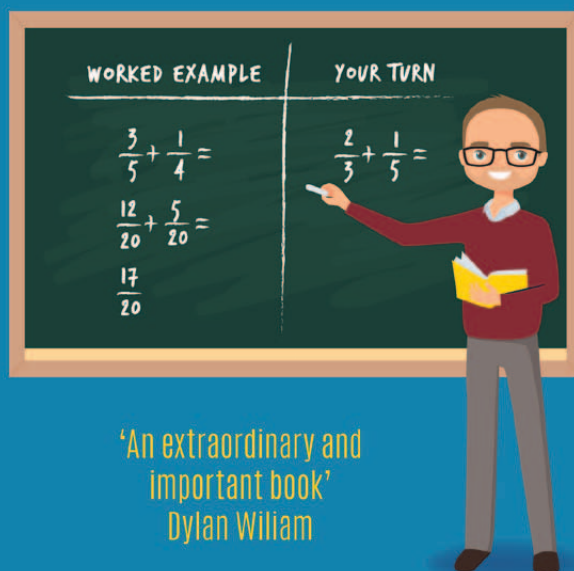
HOW I WISH I'D TAUGHT MATHS

LESSONS LEARNED FROM RESEARCH, CONVERSATIONS WITH EXPERTS, AND 12 YEARS OF MISTAKES

BY CRAIG BARTON

A JOHN CATT PUBLICATION

—CRAIG BARTON—
HOW I WISH I'D TAUGHT MATHS
LESSONS LEARNED FROM RESEARCH, CONVERSATIONS WITH EXPERTS, AND 12 YEARS OF MISTAKES

WORKED EXAMPLE | YOUR TURN

$$\frac{3}{5} + \frac{1}{4} =$$

$$\frac{12}{20} + \frac{5}{20} =$$

$$\frac{17}{20}$$

$$\frac{2}{3} + \frac{1}{5} =$$

'An extraordinary and important book'
Dylan Wiliam

The brilliant **Craig Barton** delves into the world of academic research and emerged with a range of simple, practical, effective strategies that anyone can employ to save time and energy and have a positive impact on the long-term learning and enjoyment of students.

"An extraordinary and important book." – **Dylan Wiliam**

"A really thoughtful and thought-provoking discussion of a series of important and practical questions about the best way to teach." **Daisy Christodoulou**

"History will look back on *How I wish I'd taught maths* as a seminal book leading mainstream teachers into the new world." **William Emeny, Teacher, Researcher**

Independent thinking for education

E: enquiries@johncatt.com
T: +44 (0)1394 389850
W: johncattbookshop.com

JOHN CATT EDUCATIONAL LIMITED

COMPARATIVE JUDGEMENT – THE NEXT BIG REVOLUTION IN ASSESSMENT?

Daisy Christodoulou

Director of Education at No More Marking, Daisy outlines why teachers should rethink how they assess, why they assess, and vitally, how much time should be spent doing it.

Marking writing reliably is hard. To understand why, try this thought experiment. Imagine that you have a mathematics exam paper. It's a simple paper with just 40 questions and all those questions are fairly straightforward. One mark is available for each question, and there are no marks for method. Suppose I then give that paper to a pupil, and get them to complete it. If I then copied their answer script and gave it to a group of 100 maths teachers, I would expect that all of those teachers would agree on the mark that script should be awarded, even if they had never met before or never discussed the questions on the paper.

Now take the same pupil, and imagine they have been asked to write a short description of the town where they live. Suppose again that we copy their script, distribute it to 100 teachers, and ask them to give the script a mark out of 40. It is far less likely that the teachers will all agree on the mark that script should be awarded. Even if they had all undergone training in the meaning of the mark scheme, and met in advance to discuss what the mark scheme meant, it would be highly unlikely that they would all then independently agree on the mark that one script deserved.

To a certain extent, this is to be expected. There is no one right answer to an extended writing question, and different people will have different ideas about how to weight the various different aspects that make up a piece of writing. However, whilst we might accept that we will never get markers to agree on the exact mark, we surely do want them to be able to agree on an *approximate* mark. We may not all agree that a pupil deserves 20/40, but perhaps we can all agree that they deserve 20/40, plus or minus a certain number of marks. The larger this margin of error is, the more difficulty we have in working out what the assessment is telling us. Suppose, hypothetically, that the margin of error on this question was plus or minus 15. A pupil with 20/40 might have scored anywhere between 5 and 35! Large margins of error make it difficult to see how well a pupil is doing, and they also make it even more difficult to see if a pupil is making progress, as then you have to contend with the margin of error on two assessed pieces of work.

In order to know how well pupils are doing, and whether they are improving, we therefore need a method of reliably assessing extended writing. In order to consider how we might arrive at this, let us first look at two reasons why it is so difficult to mark extended writing at the moment.

First, traditional writing assessment often depends on absolute judgements. Markers look at a piece of writing and attempt to decide which grade is the best fit for it. This may feel like the obvious thing to do, but in fact humans are very bad at making such absolute judgements. This is not just true of marking essays, either, but of all kinds of absolute judgement. For example, if you are given a shade of blue and asked to identify how dark a shade it is on a scale of 1 to 10, or given a line and asked to identify the exact length of it, you will probably struggle to be successful. However, if you are given two shades of blue and asked to find the darker one, or two lines, and asked to find the longer one, you will find that much easier. Absolute judgement is hard; comparative judgement is much easier, but traditional essay marking works mainly on the absolute model.[1]

Second, traditional writing assessment depends on the use of prose descriptions of performance, such as

> Comparative judgement offers a way of assessing writing which does not involve difficult absolute judgements and which also reduces reliance on prose descriptors.

those found in mark schemes or exam rubrics. The idea is that markers can use these descriptions to guide their judgements. For example, with one exam board, the description for the top band for writing is described in the following way:

- Writing is compelling, incorporating a range of convincing and complex ideas
- Varied and inventive use of structural features[2]

The next band down is described as follows:

- Writing is highly engaging, with a range of developed complex ideas
- Varied and effective structural features

It is already not hard to see the kinds of problems such descriptors can cause. What is the difference between 'compelling' and 'highly engaging'? Or between 'effective' use of structural features and 'inventive' use? Such descriptors cause as many disagreements as they resolve, because prose descriptors are capable of being interpreted

in a number of different ways. As Alison Wolf says, 'One cannot, either in principle or in theory, develop written descriptors so tight that they can be applied reliably, by multiple assessors, to multiple assessment situations.'[3]

Comparative judgement offers a way of assessing writing which, as its name suggests, does not involve difficult absolute judgements, and which also reduces reliance on prose descriptors. Instead of markers grading one essay at a time, comparative judgement requires the marker to look at a pair of essays, and to judge which one is better. The judgement they make is a holistic one about the overall quality of the writing. It is not guided by a rubric, and can be completed fairly quickly. If each marker makes a series of such judgements, it is possible for an algorithm to combine all the judgements and use them to construct a measurement scale.[4] This algorithm is not new: it was developed in the 1920s by Louis Thurstone.[5] In the last few years, the existence of online comparative judgement engines has made it easy and quick for teachers to experiment with such a method of assessment.

At No More Marking, where I am Director of Education, we have used our comparative judgement engine for a number of projects at primary and secondary. In our assessments of pupils' writing, we can measure the reliability of our markers, and we are routinely able to reduce the margin of error down to just plus or minus 2 marks on a 40-mark question. Teachers are also able to complete these judgements relatively rapidly, leading to reductions in workload too. In the longer term, our hope is that wider use of comparative judgement will allow teachers to identify promising teaching methods with greater accuracy, and also to reduce the influence that tick-box style mark schemes have on teaching and learning.

To find out more, read *Making Good Progress – the Future of Assessment for Learning* (2016) by Daisy Christodoulou, published by Oxford University Press.

1 Laming, D. (2003) *Human judgment: the eye of the beholder.* Boston, MA: Cengage Learning.

2 AQA, *GCSE English Language 8700, Paper 2 Mark Scheme.* filestore.aqa.org.uk/resources/english/AQA-87002-SMS.PDF

3 Wolf, A. (1998) 'Portfolio assessment as national policy: the National Council for Vocational Qualifications and its quest for a pedagogical revolution', *Assessment in Education: Principles, Policy & Practice,* 5 (3) pp. 413–445, p. 442.

4 Pollitt, A. (2012) 'Comparative judgement for assessment', *International Journal of Technology and Design Education,* 22 (2) pp. 157–170.

5 Thurstone, L. L. 'A law of comparative judgment', *Psychological Review,* 34 (4) pp. 273–286.

CHALLENGING THE 'EDUCATION IS BROKEN' AND SILICON VALLEY NARRATIVES

Carl Hendrick

Over the last 100 years an unassailable myth about education has taken root in popular culture: the formal enterprise of education is in some way 'broken' and in urgent need of drastic reform. In the last 20 years this myth has gone into overdrive with the advent of what Audrey Watters calls the 'Silicon Valley narrative', described as 'the story that the technology industry tells about the world – not only the world-as-is but the world-as-Silicon-Valley-wants-it-to-be'. This narrative positions technology as the saviour to the 'factory model' of education, seeks to 'personalise' every aspect of learning and views knowledge as obsolete in an age of Google. However, its roots lie in a familiar kind of revolutionary zeal and entrepreneurial fatuity. Writing in 1922, Thomas Edison proclaimed that:

'I believe that the motion picture is destined to revolutionize our educational system and that in a few years it will supplant largely, if not entirely, the use of textbooks. I should say that on average we get about two percent efficiency out of school books as they are written today.' (Edison in Cuban, 1986, p. 9)

Many of the claims from the early 20th century were focused on the radio, with television being hailed as the next transformative force in the 1940s and '50s; but with the advent of computing devices in the 1960s, the notion of 'teaching machines' began to emerge and so did a narrative of technology as not just augmenting traditional education structures, but replacing them altogether.

A common trope in the 'education is broken' narrative is a sinister call for the annihilation of the teacher. A 1981 book – *School, Work and Play (World of Tomorrow)* – makes the claim that:

'If we look further into the future, there could be no schools and no teachers. Schoolwork may not exist. Instead you will have to do homework, for you will learn everything at home using your home video computer.' (Ardley, 1981, p. 54)

The advent of mass digital technology and the internet in the last 20 years led to ever more sensationalist claims that the fundamental enterprise of education is in some way in need of wholesale change or 'disruption', a term coined by Clayton Christensen in his 1997 book, *The Innovator's Dilemma*. The term refers to radical approaches, often cheaper and technology-based, which challenge and 'disrupt' existing structures and eventually supplant them with innovative alternatives. Companies like Amazon, Netflix and others are examples of disruptive technologies that have supplanted traditional ones like high street retail and video rental services, and have provided consumers with higher-quality products at a cheaper rate. However, as Martin Weller argues, the disruptive model is one that has been applied 'much more broadly than its original concept, to the point where it is almost meaningless and rarely critically evaluated' (Weller, 2014, p. 125). Just because Uber offers consumers a cheaper and more efficient alternative to cabs, it does not follow that the same model will work in education. Education's stakeholders are not 'consumers' for one thing and the

> Techno-evangelists and have sold us the internet as a form of emancipation, freeing us from the 'factory model' of education.

ultimate goal of education is not efficiency.

In his 2008 book, *Disrupting Class*, Christensen and his co-authors argue that 'disruption is a necessary and overdue chapter in our public schools' and would later claim that half of all high school classes would be taught online by 2019. Other disruptive enthusiasts like Michael Staton have claimed that the traditional credential of a higher education degree are in crisis, writing in the *Harvard Business Review* in 2014 that university degrees are 'doomed' because employers can learn much more about prospective employees who use cheaper alternatives using online apps to aggregate created content and skills:

'In these fields in the innovation economy, traditional credentials are not only unnecessary but sometimes even a liability. A software CEO I spoke with recently said he avoids job candidates with advanced software engineering degrees because they represent an over-investment in education that brings with it both higher salary demands and hubris.'

Many of these sorts of claims are focused on higher education and argue that those institutions are now bloated, anachronistic monuments to the past. In a 1997 interview in *Forbes* magazine, management consultant Peter F Drucker noted that: *'Thirty years from now the big university campuses will be relics. Universities won't survive. It's as large a change as when we first got the printed book.'*

However, despite these grandiose claims there appears to be scant evidence in which to ground them. In fact, there is an emerging picture of technology as a highly distracting influence on student's attentional capacities and their long-term ability to focus. A recent study (Ruest, 2016) showed that children who spent up to four hours a day using devices outside of schoolwork had a much lower rate (23%) of finishing their homework, compared to children who spent less than two hours using digital devices. A 2015 report from the OECD surveyed millions of students about the use of technology and correlated then with attainment scores and found that use of technology had a detrimental effect on overall student achievement.

'Students who use computers very frequently at school do a lot worse in most learning outcomes, even after controlling for social background and student demographics.' (OECD, 2015)

Many studies in technology are correlational or based on self-report; however, a more recent study (Ravizza, Uitvlugt, Fenn, 2017) sought to address these issues by objectively measuring students' use of laptops during lectures through the use of a proxy server that monitored and tracked precisely what websites were used during class. The central finding was that non-academic use of the internet in classes was highly prevalent and inversely related to performance in the final exam, regardless of interest in the class, motivation to succeed, and intelligence. In addition, using the internet for academic purposes during class did not yield a benefit in performance. The results showed that participants spent a median of 37 minutes per class browsing the internet for non-class-related purposes with their laptops and 'spent the most time using social media, followed by reading e-mail, shopping, watching videos, chatting, reading news, and playing games' (Ravizza, Uitvlugt, Fenn, 2017, p. 174) while they spent a total of four minutes browsing class-related websites.

A recent wide-ranging empirical review of the literature (Bulman, Fairlie, 2016) evaluating the impact of technology in terms of classroom use in schools and home use by students found that many policies promote investment in computer hardware or internet access and that the

'majority of studies find that such policies result in increased computer use in schools, but few studies find positive effects on educational outcomes'. A 2015 report suggests that the reason for such findings is that technology in the classroom has both positive and negative effects resulting in an overall null effect:

'Classroom computers are beneficial to student achievement when used to look up ideas and information but detrimental when used to practice skills and procedures.' (Falck, Mang, Woessman, 2015, p. 23)

More worryingly, the work of Jean Twenge suggests that the ubiquity of phones and the 'always-on' culture of social media is having a detrimental effect on the mental health of the 'iGen' generation, those born between 1995 and 2012:

'Rates of teen depression and suicide have skyrocketed since 2011. It's not an exaggeration to describe iGen as being on the brink of the worst mental-health crisis in decades. Much of this deterioration can be traced to their phones.'

It's a bleak view of the future, often described as dystopian; but for Neil Postman, there is an interesting distinction between the dystopian visions of Orwell's *Nineteen Eighty-Four* and Huxley's *Brave New World*. The former portrayed a bleak vision of oppressive state control in the form of Big Brother which sought to actively ban expression and limit human agency; however, in *Brave New World* there is a far more horrifying phenomenon at work:

'In Huxley's vision, no Big Brother is required to deprive people of their autonomy, maturity and history. As he saw it, people will come to love their oppression, to adore the technologies that undo their capacities to think. What Orwell feared were those who would ban books. What Huxley feared was that there would be no reason to ban a book, for there would be no one who wanted to read one.' (Postman, 1985, p. 10)

It must be said that technology has afforded us some incredible opportunities for education, such as comparative judgement or the JSTOR Shakespeare digital library where every line in his plays is hyperlinked to critical commentary. Used judiciously in a purposeful and well-structured environment, there can be many benefits for SEN students; but increasingly, we are suffering from what Sartre called 'the agony of choice' as we become more and more connected to the internet of things. Until relatively recently, you had to sit down and use a computer to connect to the internet but now even your central heating is online. Allowing kids to browse the internet in a lesson and then expecting they will work productively is like bringing them to McDonald's and hoping they'll order the salad.

Techno-evangelists and have sold us the internet as a form of emancipation, freeing us from the 'factory model' of education but often technology seems to represent a solution in search of a problem. (Interestingly, the model they seek to disrupt has in fact led to unprecedented improvements in educational outcomes. From 1900 to 2015, rates of global literacy increased from 21% to 86% of the global population.) What's notable about many of these claims is that they usually come from outside education, often from entrepreneurs with little or no experience in education and with significant financial investment in a digital utopia devoid of teachers. Perhaps the most liberating and empowering thing educators can do for young people today is to create a space for them where they can read the great works of human thought undisturbed and where we can 'disrupt' the current culture of distraction.

Carl Hendrick is author of *What Does This Look Like in the Classroom?* and the Head of Learning and Research at Wellington College where he teaches English. He is also completing a PhD in education at King's College London.

@C_hendrick

chronotopeblog.com

REFERENCES

Ardley, N. (1981) *School, work and play (world of tomorrow).* London: Franklin Watts Library.

Bulman, G. and Fairlie, R. (2016) 'Technology and Education: Computers, Software and the Internet,' in *Handbook of the Economics of Education,* ed. Eric A. Hanushek et al. (Elsevier), 239–280.

Christensen, C. (2011) *The innovator's dilemma: when new technologies cause great firms to fail.* Boston: Harvard Business School Press.

Cuban, L. (1986) *Teachers and Machines: The Classroom Use of Technology Since 1920.* New York: Teachers College Press.

Falck, O. Mang C. & Woessmann, L (2015) 'Virtually No Effect? Different Uses of Classroom Computers and their Effect on Student Achievement', CESifo Working Paper No. 5266, March 2015

Lamont Johnson, D. & Maddux, C. (2003) 'Technology in education: a twenty-year retrospective', *Computers in the Schools,* 20 (1/2)

OECD (2015) 'Students, Computers and Learning: Making the Connection', PISA, OECD Publishing, available at: dx.doi.org/10.1787/9789264239555-en accessed 05.12.2017

Postman, N. (1985) *Amusing Ourselves to Death: Public Discourse in the Age of Show Business.*

Ravizza, S. M., Uitvlugt, M. G., Fenn, K. M. (2017) 'Logged In and Zoned Out: How Laptop Internet Use Impacts Classroom Learning', *Psychological Science,* 28:171-180

Ruest S, et al. (2016) 'Digital Media Exposure in School-Aged Children Decreases the Frequency of Homework' Abstract 319984. Presented at: AAP National Conference and Exhibition; Oct. 21-25, 2016; San Francisco.

Watters, A. (2016) *The Curse of the Monsters of Education Technology.* Tech Gypsies.

Weller, M. (2014) *Battle for Open: How openness won and why it doesn't feel like victory.* London: Ubiquity Press. DOI: doi.org/10.5334/bam

In the first of a series, Dr Pedro De Bruyckere explores the reality behind some of the more popular misconceptions in education, and asks if there is any truth in them.
This issue: learning styles

THE GREAT PRETENDER – THE TRUTH BEHIND LEARNING STYLES

I'll start this piece with a little confession. As a songwriter I couldn't help including a song about my job as an educational myth-buster on the first album of my band. On *Kiss Me Twice* by Blue and Broke, there's a song called 'Naïve' and one line of the song provided some inspiration for the title of these short articles on education myths: 'There is some truth in every lie.'

What Paul Kirschner, Casper Hulshof and myself have discovered over the past few years is that there are often some grains of truth hidden in ideas that can rightfully be called *Urban Myths about Learning and Education*. For example, the shape of the infamous learning pyramid – one of my favourite myths that I call 'the Loch Ness Monster of education' – is actually based on one of the oldest theories on the use of multimedia in the classroom, the 'Cone of Experience' by Edgar Dale...from 1946!

Maybe I'll tackle that myth later in the series, but let's first start with another big one: what is the grain of truth hidden in learning styles?

The myth in short
For the people who think you should adapt your teaching to the supposed learning styles of your pupils, know this:
1. There is no evidence that it works
2. There are plenty of different categorisations
3. If you think it works, you can try to win $5000!

If you'd like to know how to win the prize, I'll share the short version[1] with you. Take at least 70 pupils and give them all a learning style test. I'll explain what you need to do with two possible learning styles (auditory and visual learners) but you can pick whatever theory you like (e.g., Kolb, Honey and Mumford, Felder-Silverman, etc.) from the 71 known categorisations (Coffield et al., 2004). Then you'll need to organise the groups into two conditions:

1. Group 1 will be taught according to their assumed learning style. The visual learners will get their information graphically presented; the auditory learners will get to listen to the information.

2. Group 2 will be taught according to the *opposite* of their assumed learning style. The auditory learners will get their information shown to them, the visual learners will get to listen to the information.

You randomly put half of the 70 pupils in the first group, the other 35 in the second group. If you can demonstrate that the pupils in group 1 have learned a sizeable amount more than the pupils in group 2, you might be in line to win the $5000 reward that Will Talheimer offered many years ago. Check his website for the longer version of the challenge. Do note, however: nobody has succeeded yet.

There is no correlation between following your learning preferences and better learning results.

The grain(s) of truth in the myth

As with most myths, there's a grain of truth lurking somewhere. In fact, there are actually two grains of truth in the learning styles myth: a misleading one and a potentially helpful one.

Let's start with the more misleading truth: people probably do not have a *learning style* – a best way of learning that a teacher needs to adapt to; however, people do often have learning preferences. Why is this a bit misleading? It's because people become convinced that these preferences are the best way to learn: 'Yeah, I just have to write stuff down and I will remember it best that way.' There is a sad fact I need to share with you though: there is no correlation between following your learning preferences and better learning results (e.g., Rogowsky et al., 2015).

The second grain of truth is more helpful. If you combine different modalities (e.g. both visual and auditory senses) people will typically learn more. For example, dual-coding theory suggests that it's better to combine images with words if you want to remember something (e.g., Mayer & Anderson, 1992).

I'll leave you with Yana Weinstein (2016) from The Learning Scientists, who offers a great four-step summary of the science:

1. People have preferences for how they learn.
2. All people learn better when more senses are engaged.
3. Some people benefit from additional modalities more than other people.
4. No one suffers from the addition of a modality that's not their favourite.

---

[1] Check this page for the long version: www.worklearning.com/2014/08/04/learning-styles-challenge-year-eight/

REFERENCES

Coffield, F., Moseley, D., Hall, E., and Ecclestone, K. (2004) *Learning styles and pedagogy in post-16 learning: a systematic and critical review.* London: Learning and Skills Research Centre.

Rogowsky, B. A., Calhoun, B. M., & Tallal, P. (2015) 'Matching learning style to instructional method: effects on comprehension', *Journal of Educational Psychology*, 107 (1) pp. 64–78.

Mayer, R. E., & Anderson, R. B. (1992) 'The instructive animation: helping students build connections between words and pictures in multimedia learning', *Journal of Educational Psychology*, 4, pp. 444–452.

Weinstein, Y. (2016) 'Just semantics? Subtle but important misunderstandings about learning styles, modalities, and preferences', *The Learning Spy* [blog]. www.learningspy.co.uk/featured/just-semantics-subtle-but-important-misunderstandings-about-learning-styles-modalities-and-preferences/

research ED

WORKING OUT WHAT WORKS

What is researchED?

ResearchED is an international, grassroots education-improvement movement that was founded in 2013 by Tom Bennett, a London-based high school teacher and author. ResearchED is a truly unique, teacher-led phenomenon, bringing people from all areas of education together onto a level playing field. Speakers include teachers, principals, professors, researchers and policy makers.

'I didn't build researchED,' says Tom, 'it wanted to be built. It built itself. I just ran with it.'

Since our first sell out event, researchED has spread all across the UK, into the Netherlands, Norway, Sweden, Australia, the USA, with events planned in Spain, Japan, South Africa and more. We hold general days as well as themed events, such as researchED Maths & Science, or researchED Tech.

As far as I am concerned, researchED is one of the most exciting and important developments in education in recent years. By providing a way of engaging practicing teachers with cutting edge research, it provides, in my view, the best opportunity we have of using research in a principled way in teaching.
*– **Dylan Wiliam**
   Emeritus Professor of Educational Assessment, UCL*

The goal of researchED is to **bridge the gap between research and practice in education.** Researchers, teachers, and policy makers come together for a day of information-sharing and myth-busting.

researchED.org.uk

Who are we?

Since 2013 researchED has grown from a tweet to an international conference movement that so far has spanned three continents and six countries. We have simple aims: to help teaching become more evidence-facing; to raise the research literacy in teaching; to improve education research standards; and to bring research users and research creators closer together. To do this we hold unique one day conferences that brings together teachers, researchers, academics and anyone touched by research. We believe in teacher voice, and short circuiting the top down approach to education that benefits no one.

ResearchED originated in the UK in 2013 and has since forged a community of tens of thousands of educators and of 100+ speakers who subscribe to our mission, waive their fees and make themselves available to speak at many of our conferences.

ResearchED is the first organisation to bring together teachers administrators, and researchers into the same space for the kinds of frank exchanges they need to have if teaching is to become evidence facing- in other words a profession, with all that entails. That there is a need and hunger for this organization within teaching may be adduced by researchED's explosive international growth. It has the potential to be a revolutionary force in education, professional development, teacher training, and the way that teachers engage with research, and vice versa.
– Professor Daniel Willingham
   University of Virginia, USA

A new model for continuing professional development

The gathering of mainly teachers, researchers, school leaders, policymakers and edu-bloggers creates a unique dynamic. Teachers and researchers can attend the sessions all day and engage with each other to exchange ideas. The vast majority of speakers stay for the duration of the conference and visit each other's sessions and work on the expansion of their knowledge and gain a deeper understanding of the work of their peers. Teachers can take note of recent developments in educational research, but are also given the opportunity to provide feedback on the applicability of research or practical obstacles.

How does it work?

Saturday events
Events on a Saturday, so more people can attend without asking school

Rock bottom prices
Low ticket prices– we want everyone to be able to afford it- that's why we're a non profit

Teacher-led
Find out ways you can get involved on the day

Open to all
Our speakers range from Professors to teaching assistants

Ways you can get involved:

Attend a researchED event

Share your evidence-informed research as a speaker

Volunteer for a local event

Donate to researchED

Get in touch

contact@researchED.org.uk

@researchED1

www.researchED.org.uk

research ED

THE SCIENCE OF LEARNING

Benjamin Riley and Charis Anderson

US-based Deans for Impact are not only one of the leading organisations driving evidence-informed teacher training, but also ground-breaking communicators of evidence-informed education. And one of their most successful publications, *The Science of Learning*, is part of that success. Benjamin Riley and Charis Anderson explain what it is, and why it has proven such an international success.

When Deans for Impact launched in 2015, its members – all leaders of US educator-preparation programmes – wanted to chart a new course in education that pushed for the broader use of scientifically supported learning principles within programmes that prepare future teachers. At the same time, we wanted to make sure whatever we did would resonate with practising educators in the field. Could we create a resource to do both?

From this question, *The Science of Learning* – a short, six-page summary of principles of cognitive science and their application to teaching practice – was born. Three years after its publication, it remains the most widely used resource Deans for Impact has developed, with ongoing international interest. And we think the reason for this stems in part from the fact that the main authors of *The Science of Learning* – Daniel Willingham and Paul Bruno – spanned the 'research to practice' divide that so often creates a barrier to improving education.

Willingham, a professor at the University of Virginia, is a cognitive scientist. Earlier in his career, his research focused solely on the brain basis of learning and memory, but since around 2000, he has focused on the application of cognitive psychology to K-16 education. *The Science of Learning* offered Willingham another opportunity to bring information about cognitive psychology to educators in a useful way.

By contrast, when Bruno started working on *The Science of Learning*, he was fresh out of the classroom after spending five years teaching middle-school science in Oakland and Los Angeles. Bruno's own teacher-preparation experience had left him with relatively little understanding of the science of learning, and much of what he did know he learned on his own. Based on his own experience, Bruno thought there was an enormous need to help make learning-science research accessible for educators.

'I think it's great when teachers take the initiative and want to dive into the research themselves,' said Bruno, who is now a PhD student at USC Rossier. 'But I think it is pretty unfair, for most teachers, to demand that they do that proficiently: that's not their job.'

There's a distinction between being a practitioner and being a researcher of how the mind works, according to Willingham. 'Knowing what the mind does is not identical to knowing how to put those principles into practice in a classroom,' Willingham said.

The Science of Learning focuses on the cognitive view of learning in order to focus on those principles that are most applicable to what teachers do in classrooms, such as helping students understand new ideas or motivating students to learn. The principles are organised through six framing questions – e.g., how do students understand new ideas? – and are paired with specific, concrete implications for instruction. Above all, *The Science of Learning* makes the research accessible.

The field of education often lacks clear paths to keep practitioners up to date on the latest relevant research. This stands in contrast to other professions, such as the medical field, where the American Medical Association

takes an active interest in continuing education for physicians, according to Willingham. But in teaching, 'I would say that most teachers feel they're sort of on their own in navigating the research world and figuring out what's new in research and what's quality,' Willingham said. Bruno agreed. 'Particularly for a new teacher, it can be very helpful to have something like *The Science of Learning* that you can get your arms around and is relatively digestible,' he said.

The lack of specificity or clarity in standards and other guidance given to teachers – both novice and more experienced – is also a real problem, in Bruno's eyes. For example, teachers are told that it's important for their students to have foundational knowledge as a precursor for critical thinking – but what is meant by 'having foundational knowledge'? And what specific things do teachers need to do to help their students gain that knowledge?

'A lot of times, educational advice can sound very aspirational, and watching teachers who are good can often seem like you're watching something that's indistinguishable from magic,' Bruno said. A novice teacher who is told to differentiate her instruction, but isn't given clear directions on what that means or looks like – or even on what basis instruction needs to be differentiated – will be left fishing for plausible ways of achieving the objective.

It's in these types of situations where neuromyths like learning styles can easily take hold, Bruno believes. 'Learning styles seems to offer some of this concreteness: take the activity you were doing, and turn it into something visual, or something kinesthetic,' he said. 'That seems actionable, and it's something to latch onto.'

Empowering individual teachers with knowledge of learning science principles can change the way instruction is delivered in individual classrooms and contribute to changing the norms of the profession. Indeed, while we originally conceived of *The Science of Learning* as a tool to support *individual learning*, at Deans for Impact we've increasingly come to see the principles of learning science as central to organisational learning as well. We're now using *The Science of Learning* to undergird a vision of change within educator-preparation programmes that prioritises candidate learning above all else.

In our most recent publication, *Building Blocks*, we laid out a vision for effective educator preparation that connects learning-science principles with practical considerations about how teacher preparation should be designed. In this vision, not only do teacher-educators teach and model behaviours that are aligned with our best scientific knowledge, but programmes themselves are designed with that knowledge at their core.

When teacher-educators model effective pedagogy, for example, it gives aspiring teachers 'worked examples' – step-by-step demonstrations that break down a teaching practice into its component parts – that reduce their cognitive burdens and help them see and understand the underlying concepts.

Interleaving practice opportunities throughout teacher-candidates' preparation experience helps them better learn content and understand theory and practice as interrelated concepts. Pairing those practice opportunities with feedback that is targeted toward developing a specific skill and given as soon as possible after the skill is practice – and giving teacher-candidates another opportunity to practice the skill – make them powerful levers for improvement.

Finally, designing the arc of the preparation process to build teacher-candidate knowledge, skill, and understanding over time helps align theory to practice and creates a coherent experience for all candidates. This approach to program design is based one of the bedrock principles of cognitive science: that we learn new ideas by referencing ideas we already know.
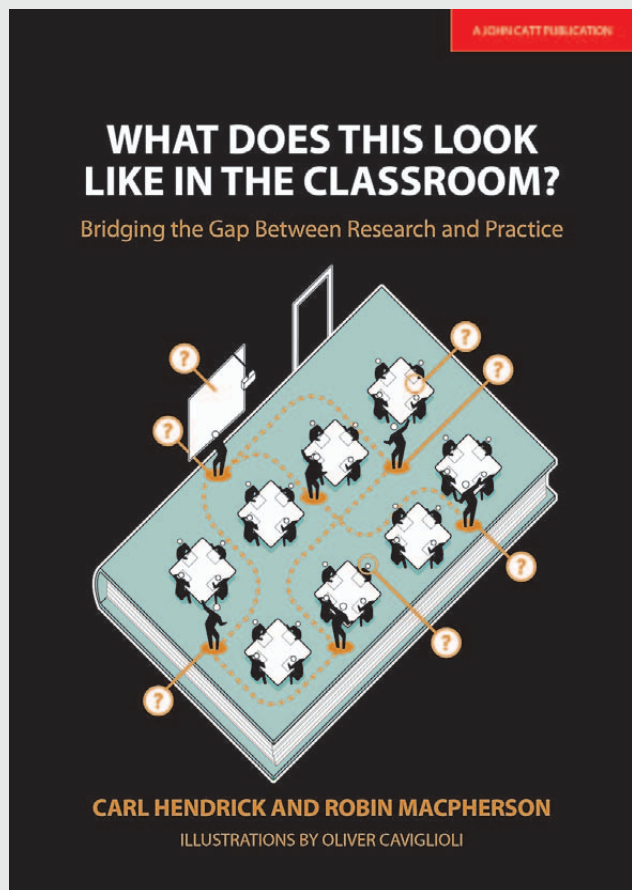
Three years after Deans for Impact first conceived the idea for *The Science of Learning*, it continues to guide much of our work. We believe that cognitive science can drive improvements within individual teachers' classrooms and within the organizations that prepare those teachers – and researchED is playing a pivotal role in helping spread these ideas across the globe. We have made a great deal of progress – and our best work lies ahead.

You can download all Deans for Impact publications (including *The Science of Learning* and *Building Blocks*) for free here: deansforimpact.org/resources

---

Founded in 2015, **Deans for Impact** is a US nonprofit organisation that empowers, supports, and advocates on behalf of leaders at all levels of educator preparation who are committed to transforming the field and elevating the teaching profession.

Benjamin Riley is the founder and executive director of Deans for Impact. Prior to founding Deans for Impact, Ben conducted research on the New Zealand education system, worked as the policy director for a national education nonprofit, and served as deputy attorney general for the State of California. He received his bachelor's degree from the University of Washington and JD from the Yale Law School.

Charis Anderson is the senior director of communications at Deans for Impact. Prior to joining Deans for Impact, she was the director of publications for a Boston-based national education nonprofit. Charis also worked as a reporter at a local newspaper in Massachusetts, for an independent high school in San Francisco, and at a management consulting firm. Charis received her bachelor's degree in psychology from Williams College and her master's degree in journalism from Columbia University Graduate School of Journalism.

RESEARCH THAT CHANGED MY TEACHING

In the first of a series in which educators explain how research has transformed their practice, English and media teacher Hélène Galdin-O'Shea tells us about one paper that changed everything for her classroom.

Research paper: 'Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching'

Authors: Kirschner, Sweller and Clark, 2006.

The end of my first decade as a teacher was nearly the end of my career as a teacher. I had become so frustrated with the way in which 'outstanding' teaching was defined and enforced that I was ready to give up. It was a horrendous regime of having lessons graded against a never-ending tick-list of dubious items and the dual premises of minimal teacher talk (no more than five to ten minutes and based in great part on the flawed – and now thankfully debunked – cone of learning or learning pyramid) complete with compulsory group work (or a 'fail'), and finding a way to demonstrate 'visible progress' in 20 minutes. Five minutes of talking is just about enough to give a set of learning objectives and a set of instructions for group work if you want to avoid utter confusion when the signal is given.

Organising resources which are accessible and will give students something from which they can learn new information on their own is time-consuming enough, but add to that the provision of clearly defined roles for group members in order to make them 'accountable', and tasks through which students can engage with the materials, can do 'something' with the knowledge and prepare to feedback in a way that does not make students and

teacher want to kill themselves after group 3 of 6 have had a go – well, all that is quite a feast. Dishearteningly, my role of 'facilitator' often led to the need to re-teach the materials – and 'un-teach' misconceptions. Could the group work task have worked better with clearly guided instruction at the start? Certainly so. But these were the rules of the game then. And boy, did I try!

When the focus of lesson planning becomes 'What can I do in order not to explain this explicitly?' as opposed to 'How can I refine my explanations and polish the scaffolding work to maximise students' understanding?', something has to shift. It had become painfully obvious that the way 'independent learning' (as cited in the 'outstanding lesson' criteria) had come to be interpreted in schools was unhelpful. Did it really mean letting students struggle mostly on their own trying to make sense of the materials, organising themselves and others, formulating a response, and preparing to feed back that response? Even with timely interventions to redirect or explain, the process was painful, particularly for students who had a lower starting point. Why not provide more structured guidance with instant corrective feedback to start with?

After 13 years on the job, I went online, connected with many colleagues, and started reading. I am eternally grateful to whoever pointed in the direction of a paper which gave me new teacher-life, so to speak. It was a paper by Paul Kirschner, John Sweller and Richard Clark (2006) titled **'Why minimal guidance during instruction does not work: an analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching'** in which the authors make the case for fully guided instruction and the idea that most people learn best when provided with explicit instructional guidance. They argue that it is an 'instructional procedure' that takes

The aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned

into consideration the 'structures that constitute human cognitive architecture' with over 50 years of evidence from empirical studies to support its effectiveness.

A couple of years later, someone shared a follow-up article which had been published in *American Educator* in 2012 – 'Putting students on the path to learning: the case for fully guided instruction' – which, to this day, I use with teacher trainees as it presents the research evidence in a very clear and accessible way. The first paper helped me redefine what had become for me a bête noire: the concept of 'independent learning', and what it may mean, firstly by shifting the idea to 'independent practice', and more broadly by conceptualising it as guiding students towards independent learning from a novice status to a more expert one over the course of a unit of study but also over the course of a year, a key stage, one's formal education. In this model, guided then independent practice logically follows carefully guided instruction, feedback is proffered as an ongoing process and its two-way nature is reinforced as the teacher tweaks instruction taking cues from student response. It seems obvious now but the concept of cognitive load was an

eye-opener in so far as it greatly explained why many of my students had struggled to learn and retain information through the convoluted tasks I used to prepare for them.

The paper also opened for me the ideas behind the role of memory in learning and allowed me to plan sequences of lessons aimed at carefully revisiting and building on knowledge, taking into consideration ways in which I could help my students with 'knowledge organisation and schema acquisition'. They suggested that 'there is also evidence that [unguided instruction] may have negative results when students acquire misconceptions or incomplete or disorganised knowledge', which again chimed strongly with my experience. The lofty aims of 'higher-order thinking' that we were asked to prioritise now made sense as part of a carefully orchestrated and rehearsed foundational knowledge base, since 'expert problem solvers derive their skill by drawing on the extensive experience stored in their long-term memory and then quickly select and apply the best procedures for solving problems.' The paper culminated for me in the assertion that 'the aim of all instruction is to alter long-term memory. If nothing has changed in long-term memory, nothing has been learned.'

The authors also introduced me to the worked example effect and the expertise reversal effect, the latter being summed up in: 'The advantage of guidance begins to recede only when learners have sufficiently high prior knowledge to provide "internal" guidance.' After a few years of chewing over these concepts and reading far more about them (starting with Barak Rosenshine's 'Principles of instruction'), I find it hard to believe that I was not introduced to these ideas at the start of my career. I am certain that teachers get a much better deal today but my own training can broadly be summed up by 'Do group work'.

Now at the end of my second decade as a teacher, I feel more at peace with my practice and enthused about the future, knowing that I still have much to learn, practise and refine, but also knowing that there is a clearer path ahead in terms of finding helpful reading and research evidence, and having colleagues with whom discussions focus on student learning as opposed to nebulous proxies.

REFERENCES

Benjes-Small, C. (2014) 'Tales of the undead…Learning theories: the learning pyramid', *ACRLog* [blog]. acrlog.org/2014/01/13/tales-of-the-undead-learning-theories-the-learning-pyramid/

Kirschner, P. A., Sweller, J. & Clark, R. E. (2006) '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) pp. 75–86. www.cogtech.usc.edu/publications/kirschner_Sweller_Clark.pdf

Clark, R., Kirschner, P. and Sweller, J. (2012) 'Putting students on the path to learning: the case for fully guided instruction', *American Educator*, 36 (1) pp. 6–11. www.aft.org/sites/default/files/periodicals/Clark.pdf

Rosenshine, B. (2012) 'Principles of instruction: research-based strategies that all teachers should know', *American Educator*, 36 (1) pp. 12–19, 39. www.aft.org/sites/default/files/periodicals/Rosenshine.pdf

THE PSYCHOLOGY OF HABITS

Joe Kirby

Teacher, blogger and trainer Joe Kirby takes a look at the force of habit – one of the most powerful influences we have on our behaviour whether we like it or not – and how we can use this in school.

Scientific research suggests that cues and consistency make habits last.
Why do we automatically wash our hands after going to the toilet? Why do we automatically tend to put our seatbelt on when we get into a car? Why do we tend to forget our New Year's Resolutions by March?

These puzzles can partly be explained by the psychology of habit. Knowing this scientific research can come in very handy as teachers and school leaders.

Scientific research
In 1899, one of the founders of modern psychology, William James, gave some talks to teachers on the human mind. 'It is very important that teachers realise the importance of habit, and psychology helps us greatly at this point ... Habits cover a very large part of life,' James argued; much of our activity is automatic and habitual. 'The more of the details of our daily life we can hand over to the effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work' (James, 1899).

Research a century on suggests that around 45% of our daily actions are habitual (Wood et al., 2002; Wood et al., 2005; Wood & Neal, 2007; Evans & Stanovich, 2013). Scientifically, habits are learned, contextual, automatic responses (Verplanken & Aarts, 1999; Wood & Neal, 2007). Simply repeating an action consistently in the same context leads to the action being activated on later exposure to the same cue (Lally & Gardner, 2013). Using the toilet is the cue for washing our hands. Getting into a car is the cue for putting on a seatbelt. When a specific behaviour is performed repeatedly in an unvarying context, a habit will develop. Habits, scientists have found, do not rely on conscious attention or motivation, so persist even after conscious motivation or interest dissipates (Bargh, 1994). Habits free mental resources for other tasks. For example, learning to drive requires conscious attention to the pedals at first, but after that becomes a learned habit, attention is freed for scanning the road and for conversation. Decades of studies show that habit strength increases following repetition of a behaviour after the same cue (Hull, 1943; Lally et al., 2010; Lally et al., 2011). Cues and consistency combine to create a new habit. One study showed that it took an average of 66 days for a habit to form, with a range of 18 to 254 days (Lally et al., 2010). The time taken for automating the habit depended partly on the complexity of the habit: drinking a glass of water every day is easier than doing 50 sit-ups every day. Psychologists now argue that habit formation advice – that is, to repeat an action consistently in the same context – offers a simple path to long-term behaviour change (Gardner, Lally & Wardle, 2012).

Cues and consistency

In schools, we can use the power of habit to improve our pupils' lives, just as a parent says to their child, 'What's the magic word?' to teach them to be thankful and thoughtful. From the research evidence, two principles suggest themselves to make a habit last:

1. **Choose a 'cue' or a reminder that occurs without fail at least daily.**

2. **Repeat the action consistently after the cue for as many days in a row as possible.**

The best cues recur unfailingly, such as waking up or entering or leaving a lesson. This explains why so many of us forget our New Years' resolutions: because we haven't turned them into daily habits with unfailing cues or consistency.

Greeting people professionally is a useful habit for young people to learn for any interview they attend and anywhere they work later in life. A simple cue is seeing a teacher. I have seen how teaching pupils to smile and greet teachers cheerfully with 'good morning!' or 'good afternoon!' helps pupils learn how to interact positively and politely. Because this cue occurs many times a day at school, pupils have many chances every day to practise. Some pupils already have this automated, and are at an advantage in later life. Schools can help all pupils to achieve this advantage by teaching and reinforcing it consistently until it is an automatic habit for everyone.

Pupils have to remember lots of items every day: uniform, books, equipment, homework and kit. Quite often, something gets forgotten. Checking they've got what they need in their bag the night before and in the morning is a useful habit. A simple cue is to check their bag just after they've woken up. When it comes to exams, having this habit automated hugely reduces stress, pressure and panic.

Focusing on with practice in lessons straight away and not time-wasting is another habit that gives pupils great advantages that accumulate rapidly over time. Compared to a pupil who wastes just the first two minutes of practice each lesson, a pupil who focuses gains an extra 10,000 minutes of learning from Year 7 to Year 11. A simple cue to start practice such as 'Ready…go!' is powerful when it is consistently applied. If all teachers in the school give the same cue, it makes it easier for pupils to establish the habit.

If teachers and school leaders decide collective cues and ensure consistency together, they can set their pupils up for habitual success.

REFERENCES

Bargh, J. A. (1994) 'The four horsemen of automaticity: awareness, intention, efficiency, and control in social cognition' in Wyer, R. S. & Srull, T. K. (eds) *Handbook of social cognition, vol. 1: basic processes*. Hove: Lawrence Erlbaum Associates, pp. 1–40.

Evans, J. & Stanovich, K. (2013) 'Dual-process theories of higher cognition: advancing the debate', *Perspectives on Psychological Science*, 8 (3) pp. 223–241.

Gardner, B., Lally, P. & Wardle, J. (2012) 'Making health habitual: the psychology of "habit-formation" and general practice', *The British Journal of General Practice*, 62 (605) pp. 664–666.

Hull, C. L. (1943) *Principles of behavior: an introduction to behavior theory*. New York, NY: Appleton-Century-Crofts.

James, W. (1899) *Talks to teachers on psychology*. New York, NY: Metropolitan Books/Henry Holt and Company.

Lally, P and Gardner, B. (2013) 'Promoting habit formation', *Health Psychology Review*, 7 (sup. 1) pp. 137–158.

Lally, P., Wardle, J. & Gardner, B. (2011) 'Experiences of habit formation: a qualitative study', *Psychology, Health & Medicine*, 16 (4) pp. 484–489.

Lally, P., van Jaarsveld, C. H. M., Potts, H. W. W. & Wardle, J. (2010) How are habits formed: modelling habit formation in the real world. *European Journal of Social Psychology*, 40 (6) pp. 998–1009.

Verplanken, B. & Aarts, H. (1999) 'Habit, attitude, and planned behaviour: is habit an empty construct or an interesting case of goal-directed automaticity?', *European Review of Social Psychology*, 10 (1) pp. 101–134.

Wood, W. & Neal, D. T. (2007) 'A new look at habits and the habit-goal interface', *Psychological Review*, 114 (4) pp. 843–863.

Wood, W., Quinn, J. M. & Kashy, D. A. (2002) 'Habits in everyday life: thought, emotion, and action', *Journal of Personality and Social Psychology*, 83 (6) pp. 1281–1297.

Wood, W., Tam, L. & Witt, M. G. (2005) 'Changing circumstances, disrupting habits', *Journal of Personality and Social Psychology*, 88 (6) pp. 918–933.

READ THIS BOOK NOW!
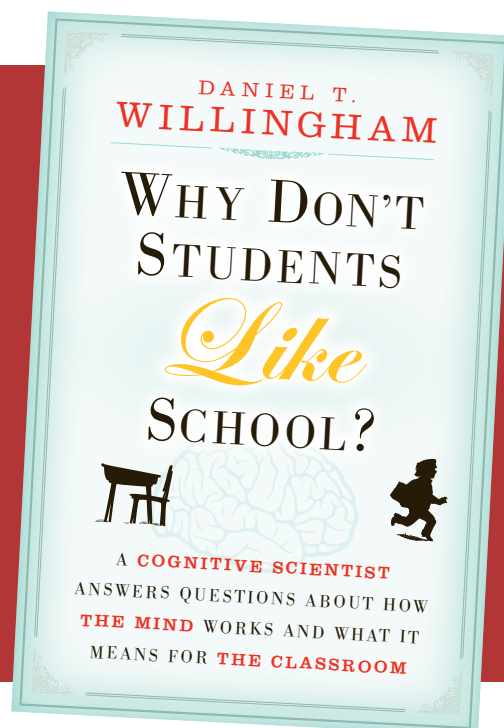
THIS ISSUE:
Why Don't Students Like School?
by Daniel Willingham

Tom Sherrington

Published in 2010, Professor Daniel Willingham's book *Why Don't Students Like School?* set out to describe as simply as possible – but no simpler – the main lessons that cognitive psychology could teach us about memory, learning, focus, motivation and a host of other topics vital to education. In doing so, it helped catalyse a revival in the interest of evidence-informed education that is still blowing up around the world. Consultant and former headteacher Tom Sherrington tells us why it turned the way he taught and led teaching upside down.

It's incredible to consider that, as teachers, we're only recently beginning to understand the processes we muddle through every day. Thankfully, help is at hand. Way up high on my list of 'books every teacher should read' is *Why Don't Students Like School?* by Daniel Willingham. Packed with insights, it's a masterpiece of communication, making the complex world of cognitive science accessible for teachers.

Written in 2009, the book continues to be highly influential. My recent re-reading made me realise just how many ideas I've encountered in the last few years are covered in the book – from his sound debunking of learning styles to his exploration of knowledge as the foundation of skills and the famous line 'memory is the residue of thought'. Of course, Willingham is not alone in his field but, without question, he is one of its best communicators

> **Willingham acknowledges how hard it is to build abstract understanding while also giving very clear guidance as to where to focus our energies.**

and we owe him a great deal for his ability to penetrate the wall of institutional inertia and edu-dogma with evidence and wisdom.

My favourite chapter in *Why Don't Students Like School?* is 'Why do students forget everything I say?' This frustration resonates widely with teachers I talk to. Willingham offers advice that he suggests 'may represent the most general and useful idea that cognitive psychology can offer teachers': ***Review each lesson plan in terms of what the student is likely to think about.*** Superficially this may sound blindingly obvious but actually it requires a great deal of thought.

Take an example – learning about thermal decomposition in chemistry. A teacher might reasonably think it useful – as well as memorable – to explore this by engaging in a practical experiment. If you heat copper carbonate, a green powder, it becomes copper oxide, a black powder, plus invisible carbon dioxide. However, if you consider what students think about whilst doing an experiment, largely it is the business of assembling apparatus and then the process of examining the original green stuff that turns into black stuff. Most of the thinking is at a macro human scale, not about atoms, formulae, chemical bonds or even the terminology. They will form valuable memories about doing experiments and some general ideas about chemical change – but not necessarily that copper carbonate decomposes to copper oxide or the related formula.

If you want students to learn this reaction in detail – i.e., to retain the knowledge in long-term memory – they must spend time thinking about the words and their semantic meaning; if you want them to develop a mental model of atoms being rearranged, they need to spend time thinking about a representation of the model you want them to learn.

That's my example, but one that Willingham cites is the use of PowerPoint. If you ask a class to present their findings from research on the Amazon rainforest, for example, via PowerPoint, they will need to spend time thinking about its features – fonts, graphics, animation tools and so on, especially if those skills are recently acquired. This is time they are not spending thinking about features of the Amazon rainforest. In the long term, they may retain more knowledge of the PowerPoint features than the key aspects of the Amazon because of the focus of their thinking. Memory is the residue of thought – so make students do things that give them no choice but to think about the ideas you want them to learn.

This powerful advice feeds into various other considerations. Willingham suggests teachers explicitly construct learning so that students think about what new words mean, rating them or ranking them; he recommends using ideas that create conflicts to resolve or using narrative structures that place ideas in meaningful sequences. At the same time, 'attention grabbers' and discovery learning need careful consideration because unless they provide immediate feedback that the subject is being thought about in the right way, there's a big risk that students think about the wrong things; they will remember things but not what you actually intended.

Another favourite chapter is 'Why is it so hard for students to understand abstract ideas?' The key piece of advice is to make deep knowledge the spoken and unspoken emphasis. This means avoiding giving the impression that learning some superficial facts is enough; there are always underlying models and concepts. It means making explicit comparisons between connected ideas such as literary themes or techniques in different poems, building up students' knowledge of different examples of abstract ideas, but not just learning each example at a surface level.

I love the way Willingham acknowledges how hard it is to build abstract understanding while also giving very clear guidance as to where to focus our energies. That sense of being grounded in teachers' realities helps him to communicate his thoughts. Helpfully, Willingham devotes some of his thinking to the nature of teachers' professional learning. His main advice should be no surprise: teaching, like any cognitive skill, must be practised to be improved. This needs experience – but that's not enough; it also requires conscious effort and feedback. 'Education makes better minds, and knowledge of the mind can make better education.' Amen!

THE FIGHT FOR PHONICS IN EARLY YEARS READING

Jennifer Buckingham

One of the most important things a child will do at school is learn to read, but there are few battlefields in educational discourse as contested as how to best teach it. Here, Jennifer Buckingham outlines the evidence base for systematic synthetic phonics as the most reliable method we have – and also why so many find it hard to accept.

There is extensive research on how children learn to read and how best to teach them. One of the most consistent findings from methodologically sound scientific research is that learning to decode words using phonics is an essential element of early reading instruction.[1] Language comprehension (vocabulary and understanding of semantics, syntax, and so on) is also essential to gain meaning from reading, of course. But children must first be able to accurately identify the words on the page or screen before they can bring meaning to what they are reading.[2]

Many high-quality studies over the last two decades in particular, including systematic reviews, have shown that classroom programmes and interventions with an explicit, systematic phonics instruction component are more effective in teaching children to read than those without such a component.[3] More recently, a teaching method called systematic synthetic phonics (SSP) has garnered strong evidence in its favour.[4] In synthetic phonics, teaching starts with a sequence of simple letter-sound correspondences, building to the more complex code as children master the skills of blending and segmenting.[5]

Systematic synthetic phonics is well-researched in school classrooms and in clinical settings. It is also supported by cognitive science research on the processes that take place in the brain when children learn to read.

This research shows that reading is not like speaking: the human brain is not innately wired for reading to develop automatically with exposure to print. Making the cognitive connections between print, sound and meaning requires making physical neurological connections between three distinct areas of the brain.[6] Some children create these neural connections relatively quickly but others require methodical, repeated and explicit teaching.[7] This is particularly true for a complex language like English where the relationships between letters and sounds is not uniform in all words.

Despite the clear evidence supporting systematic phonics instruction, there is still debate about the role of phonics in learning to read and how to teach it effectively. The reasons for this are many, and interrelated. While the points listed here are drawn from the Australian context and experience (particularly in the state of New South Wales), they are also relevant in other countries.

- Many teachers do not have sound knowledge of language constructs and the most effective ways to teach reading, and generally overestimate what they know.[8] A recent study of prep teachers (first year of formal schooling), found that only 53% could correctly define a morpheme and only 38% could correctly define phonemic awareness.[9] The latter is a powerful predictor of reading ability and a critical element of initial reading instruction.[10]

- Initial Teacher Education courses do not consistently provide graduate teachers with evidence-based reading instruction strategies and this is often compounded by low-quality professional learning.[11]

- Contradictions within one department lead to teachers being given strongly conflicting messages.

- For example, the NSW government reading programme 'L3' is inconsistent with a document on effective, evidence-based reading instruction produced by the same government.[12]

- Important policy decisions are frequently made by education ministers and department executives who don't have a good understanding of the

Despite the clear evidence supporting systematic phonics instruction, there is still debate about the role of phonics in learning to read and how to teach it effectively.

evidence and research. They are often guided by people whose knowledge and experience is in literacy more broadly, or even just primary education generally; while early reading instruction and intervention is a highly specialised field of research and expertise. An example of this was the NSW Ministerial Advisory Group on Literacy and Numeracy (MAGLAN), which produced a report that misrepresented important educational strategies such as response to intervention.[13]

- Very few literacy teaching programmes and interventions are subjected to rigorous trials or evaluations.[14]
- Endorsement of expensive and unproven interventions that invoke neuroscience or involve computers, or both. There are numerous programmes that claim to help children learn to read by doing anything but actually teaching them to read.[15]
- The influence of people in both the public and private sectors who continue to promote theories of reading that do not reflect current research on effective reading instruction.[16]
- Rejection of research-informed policy proposals without careful consideration of the evidence, instead relying on conspiracy theories and ad hominem attacks.[17]

- The perception of some programmes and policies as being 'too big to fail'. It can take years, and sometimes even decades, to replace them even after research has shown them to be ineffective (for example: reading recovery).[18]
- Significant investment in resources, buildings and furniture that are connected to outmoded and ineffective ways of teaching. For example:
  o Schools have spent thousands of dollars building up libraries of levelled readers and other resources designed for reading methods based around whole language and 'three-cueing' approaches. This makes it difficult for those schools to make dramatic changes to reading instruction.
  o School furniture and buildings are frequently designed in ways that do not accommodate explicit instruction pedagogies. The open classroom is one example of this: research has shown that noise levels in open classrooms are a problem for students.[19] Yet many new government and Catholic schools are being built with open classrooms that exacerbate these problems.
- Widespread misinformation about effective teaching methods, including the misrepresentation of synthetic phonics and the misuse of terms like 'explicit teaching'.[20]

Despite all of this, there are reasons for optimism. The NSW government has recently allowed public schools to use funding that was earmarked for the reading recovery programme for other reading interventions; the Australian government is negotiating with the state and territory governments to introduce a Year 1 Phonics Check; and the newest version of the Australian Curriculum has a much greater emphasis on phonemic awareness and phonics. Acknowledgement of the importance of explicit instruction is growing and becoming more accepted, even if it is not always put perfectly into practice. Much has been achieved but there is still much to be done.

Dr Jennifer Buckingham is a senior research fellow and director of the FIVE from FIVE reading project at The Centre for Independent Studies (www.fivefromfive.org.au). Jennifer's doctoral research was on effective instruction for struggling readers and she has written numerous reports and peer-reviewed articles on reading instruction and literacy policy. She is a board member of the Australian Institute for Teaching and School Leadership, an Associate Investigator at the Centre for Cognition and Its Disorders at Macquarie University, a member of the Learning Difficulties Australia Council, and recently chaired an Australian Government expert advisory panel on the introduction of a Year 1 literacy and numeracy check.

REFERENCES

1 Hulme, C. & Snowling, M. J. (2013) 'Learning to read: what we know and what we need to understand better', *Child Development Perspectives*, 7 (1) pp. 1–5.

2 Stuart, M., Stainthorp, R. & Snowling, M. J. (2008) 'Literacy as a complex activity: deconstructing the simple view of reading', *Literacy*, 42 (2) pp. 59–66. www.researchgate.net/profile/Morag_ Stuart/publication/233440978_Learning_to_read_developing_ processes_for_recognizing_understanding_and_pronouncing_ written_words/links/576bb64e08aef2a864d42e42.pdf

3 Ehri, L. C., Nunes, S. R., Stahl, S. A. & Willows, D. M. (2001) 'Systematic phonics instruction helps students learn to read: evidence from the National Reading Panel's meta-analysis', *Review of Educational Research*, 71 (3) pp. 393–447. journals.sagepub.com/ doi/abs/10.3102/00346543071003393

4 Johnston, R. S., McGeown, S. & Watson, J. E. (2011) 'Long-term effects of synthetic versus analytic phonics teaching on the reading and spelling ability of 10 year old boys and girls', *Reading and Writing*, 25 (6) pp. 1365–1384. doi.org/10.1007/s11145-011-9323-x; Seidenberg, M. (2017) *Language at the speed of sight*. New York, NY: Basic Books.

5 Five from Five (no date) 'Explicit phonics instruction'. www. fivefromfive.org.au/explicit-phonics-instruction/

6 Wolf, M., Ullman-Shade, C. & Gottwald, S. (2016) 'Lessons from the reading brain for reading development and dyslexia', *Australian Journal of Learning Difficulties*, 21 (2) 143–156. DOI: 10.1080/19404158.2016.1337364

7 Rupley, W. H., Blair, T. R. & Nichols, W. D. (2009) 'Effective reading instruction for struggling readers: the role of direct/ explicit teaching', *Reading & Writing Quarterly*, 25 (2–3) pp. 125–138. DOI: 10.1080/10573560802683523; doi. org/10.1080/10573560802683523

8 Snow, P. (2016) 'Elizabeth Usher Memorial Lecture: language is literacy is language – positioning speech-language pathology in education policy, practice, paradigms and polemics', *International Journal of Speech-Language Pathology*, 18 (3) pp. 216–228. www. tandfonline.com/doi/full/10.3109/17549507.2015.1112837

9 Stark, H. L., Snow, P., Eadie, P. A. & Goldfeld, S. R. (2016) 'Language and reading instruction in early years' classrooms: the knowledge and self-rated ability of Australian teachers', *Annals of Dyslexia*, 66 (1) pp. 28–54. link.springer.com/article/10.1007/s11881-015-0112-0

10 Melby-Lervåg, M., Lyster, S. A. & Hulme, C. (2012) 'Phonological skills and their role in learning to read: a meta-analytic review', *Psychological Bulletin*, 138 (2) pp. 322–352. dx.doi.org/10.1037/ a0026744

11 Meeks, L. J. & Kemp, C. R. (2017) 'How well prepared are Australian preservice teachers to teach early reading skills?', *Australian Journal of Teacher Education*, 42 (11) pp. 1–17. dx.doi. org/10.14221/ajte.2017v42n11.1

12 Neilson, R. & Howell, S. (2015) 'A critique of the L3 Early Years Literacy Program', *Learning Difficulties Australia Bulletin* 47 (2) pp. 7–12; NSW CESE (2017) 'Effective reading instruction in the early years of school'. Sydney: NSW Centre for Education Statistics and Evaluation. www.cese.nsw.gov.au//images/stories/PDF/ Effective_Reading_Instruction_AA.pdf

13 Buckingham, J. (2012) 'Mistakes writ large if reading goes wrong', *The Sydney Morning Herald*, 7 May. www.smh.com.au/ federal-politics/political-news/mistakes-writ-large-if-reading-goes-wrong-20120506-1y6ry.html; Ministerial Advisory Group on Literacy and Numeracy (2012) 'Report on the outcomes of consultation: literacy and numeracy action plan – initial framework'.

14 Meiers, M., Reid, K., McKenzie, P. & Mellor, S. (2013) Literacy and numeracy interventions in the early years of schooling: a literature review: report to the Ministerial Advisory Group on Literacy and Numeracy. research.acer.edu.au/policy_analysis_ misc/20

15 Han, E. (2013) 'Brain Gym claims challenged', *The Sydney Morning Herald*, 13 January. www.smh.com.au/nsw/brain-gym-claims-challenged-20130112-2cmes.html; Wood, P. (2017) 'Experts question Arrowsmith program for kids with learning difficulties', *ABC News Online*, 21 March www.abc.net.au/news/2017-03-21/experts-question-arrowsmith-program-for-learning-difficulties/8363690

16 Emmitt, M., Hornsby, D. & Wilson, L. (2013) 'The place of phonics in learning to read and write.' Australian Literacy Educators' Association. www.alea.edu.au/documents/item/773

17 Mulheron, M. (2017) 'President writes: the darker purpose', *Education* NSW Teachers Federation website. www.education. nswtf.org.au/education27/news-and-features-1/president-writes/

18 NSW CESE (2015) Reading recovery: a sector-wide analysis. Sydney: NSW Centre for Education Statistics and Evaluation. www.cese.nsw.gov.au/publications-filter/reading-recovery-evaluation

19 Mealings, K. (2015) 'Students struggle to hear in new fad open-plan classrooms', *The Conversation*, 10 February. www. theconversation.com/students-struggle-to-hear-teacher-in-new-fad-open-plan-classrooms-37102

20 Adoniou, M. (2017) 'How the national phonics test is failing England and why it will fail Australia too', *EduResearch Matters*, Australian Association for Research in Education. genius.it/ www.aare.edu.au/blog/?p=2533

research**ED**

UPCOMING EVENTS

Be part of the evidence evolution in education

- Saturday conferences
- Affordable ticket prices
- World-class speakers
- Teacher-led
- Open to all

Join our community at one of our conference days where you can hear, challenge and question experts in education research – from the classroom to the university. Work out what works for you – and when.

Event	Date
researchED Rugby	9 June 2018
researchED @ the Teach First Teacher Development conference (Leeds)	24 July 2018
researchED 2018 National Conference	8 September 2018
researchED Pretoria (South Africa)	15 September 2018
researchED Scandinavia, Malmö	22 September 2018
researcheD Scotland	22 September 2018
researcheD Philadelphia (United States)	27 October 2018
researchED Nederland	12 January 2019

Find out more at researchED.org.uk

DO YOU WANT TO SPEAK AT A researchED EVENT?

Are you doing research in your classroom or school? Do you want to share your knowledge at a researchED event? Keep reading to find out more.

Our mission

researchED's mission is to raise research literacy in the teaching profession and the education sector more generally. We do this because we believe that teaching will be improved the more it engages with evidence bases that are as substantial as possible. It is no longer acceptable for education to be governed by instinct or intuition alone. Where there is evidence – in its many forms – we should reflect upon it. Where there is research, we should face its conclusions. There must be a dialogue between the craft of teaching practice and the evidence bases that inform it. The space where these two spheres interact is where researchED operates.

What we are looking for

We are looking for speakers who can deliver sessions that further those aims. We welcome submissions from anyone with something to say about the field of evidence in education that is:

- Interesting,
- Useful,
- Important,
- Evidence-based

We welcome submissions from speakers from many areas of education: newly qualified teachers, academics, policy makers, researchers, statisticians, MRI operatives – anyone who can deliver something that meets at least some of the criteria above.

researchED welcomes submissions from all people regardless of ethnicity, sexuality, or gender. We particularly welcome submissions from under-represented peoples or groups, considering all such submissions equally. In order to redress historical and cultural misrepresentation, we would urge anyone reading this to encourage any members of underrepresented groups who wish to to send us a session submission. It would help us to improve representation (and on a personal note I would welcome the expansion of my networks for future conferences). And we will always endeavour to increase our efforts to improve representation as we grow.

We ask that all speakers be prepared to discuss their evidence bases with their audiences if asked to do so. How do you know what you claim? Obviously the definition of evidence bases will vary from session to session, but we do not solicit sessions that represent the speaker's opinion alone without sufficient substantiation.

All submissions are considered by the conference lead for suitability, how they fit into the shape and content of the day, how they overlap with other sessions, and how they serve the aims described above. The conference lead will confer with the director of researchED Tom Bennett and a decision will be made and communicated to the applicant as soon as possible. Please be aware that researchED has no capital or employees, only volunteers. As such we may take some time to reply. If this is the case, feel free to email us to remind us. Acceptance to present at researchED is at our discretion.

Thank you for considering a submission to researchED and we look forward to hearing from you!

Tom Bennett

> *Submit your session online at:*
> researched.org.uk/session-submissions/

BATTLING THE BANDWIDTH OF YOUR BRAIN
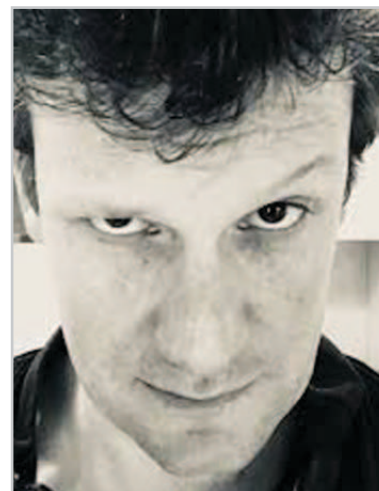
Greg Ashman

Why some people think cognitive load theory might be the most important thing a teacher can understand.

Recently, there has been a surge of interest in cognitive load theory, perhaps aided by comments made by Dylan Wiliam on Twitter that it is 'the single most important thing for teachers to know' (Wiliam, 2017). So, what is cognitive load theory, how did it arise and what are the implications for teachers in the classroom?

The origins of cognitive load theory can be traced back to the results of an experiment published by John Sweller and his colleagues in the early 1980s (Sweller, 2016). In this experiment, students were asked to transform a given number into a goal number by using a sequence of two possible moves; they could multiply by 3 or subtract 29. Unknown to the students, the problems had been designed so that they could all be solved by simply alternating the two moves e.g. ×3, −29 or ×3, −29, ×3, −29.

The students who were given these problems were all undergraduates and they solved them relatively easily. However, very few of them figured out the pattern.

By that time, it had been established that people solve novel problems by the process of means-ends analysis: Problem-solvers work backwards, comparing their current state with the goal and looking for moves that will reduce this distance. Sweller wondered whether this process drew so heavily on the mind's resources that there was nothing left to learn the pattern. In other words, solving problems induces a heavy 'cognitive load'.

It has been known since the 1950s that our short-term memory is severely limited. In a classic 1956 psychology paper, George Miller argued that the maximum number of items that can be held in memory for a short period is about seven (Millar, 1956). However, an important question arises: what is an 'item'? One of the tasks Millar examined was reciting a string of random digits, with each digit representing one item. Compare this with a string of digits such as, 'SPIDERS' – this is no longer seven items. Instead, it represents a single item because most people already possess a concept of what a spider is. An item is therefore the largest unit of meaning that we are dealing with and this will therefore depend upon what a person already knows. When we gain new knowledge – new meanings – we therefore reduce the number of items that we need to consider, a process known as 'chunking'.

We now know that different kinds of item impose different limits (Shriffin & Nosofsky, 1994). Words are generally more intensive than digits, cutting the short-term capacity further. Many cognitive scientists today accept a model of the mind that includes a 'working memory' (e.g., Baddeley, 1992). The concept of working memory is similar to that of short-term memory except that it doesn't just store information, it also manipulates it. The limitations of working memory are what lead to cognitive overload.

Sweller's initial experiments did not involve tasks that are educationally relevant and so a natural progression was to examine the kinds of problems that students are asked to solve in real academic courses. Working with Graham Cooper, Sweller tested whether school students

The concept of working memory is similar to that of short-term memory except that it doesn't just store information, it also manipulates it. The limitations of working memory are what lead to cognitive overload.

and university students learned more by solving simple algebra problems or by studying worked examples. If Sweller's hunch was correct, students may well be able to solve some of these problems, but the cognitive load imposed by this would lead them to learn little. Conversely, by imposing less cognitive load, the worked examples should lead to more learning. This was confirmed by the research (Sweller & Cooper, 1985) and this finding has now been replicated in many different situations involving a wide variety of subject matter (Sweller, 2016).

However, these results seemed counterintuitive and presented researchers with a conundrum. How is it possible for small children to pick up their mother tongue by simple immersion? Wouldn't that lead to cognitive overload? If Sweller and colleagues were right, wouldn't we need to give children worked examples of talking and listening in order for them to learn?

The answer to this problem may be found in the work of David Geary. His suggestion is that some forms of learning are 'biologically primary'. Humans have presumably been speaking a kind of language for hundreds of thousands, perhaps millions, of years and this is long enough for evolution to have had an impact, equipping babies with a

mental module for picking up language without conscious effort. In contrast, reading and writing (and all other academic subjects, for that matter) have been around for only a few thousand years and for much of that period, only a small elite engaged with them. They therefore cannot have been affected by evolution, rely on repurposing biologically primary mental modules and are therefore known as 'biologically secondary' (Geary, 1995).

Cognitive load theory suggests that all biologically secondary knowledge must pass through our limited working memories in order to be stored in long-term memory. For learning new, complex academic concepts such as algebra or grammar or the causes of the First World War – as opposed to learning simple lists – it is probably wise to try to minimise cognitive load by avoiding approaches that look like problem solving and to instead utilise those that provide clear and explicit, step-by-step guidance (Kirschner et al., 2006).

In the process of its development, cognitive load theory has also incorporated a number of learning effects that are related to the load that they impose. For instance, the 'split-attention effect' demonstrates that it is better to place labels directly on a diagram rather than provide an adjacent key because this avoids the need to cross-reference, which imposes unnecessary load. Similarly, the 'redundancy effect' shows that it is best to avoid adding unnecessary additional information for students to process. For example, if a diagram of the heart clearly shows the direction of blood flow then adding a label saying which way the blood flows is redundant (Sweller, 2016). This has clear implications for teaching – don't provide lots of text on a PowerPoint slide and simultaneously explain the same concepts verbally. In general, it is best to minimise the number of different things that students have to pay attention to at any one time. Remove those fancy borders, animations and cartoons unless they are fundamental to what is being communicated.

And this is why cognitive load theory is so powerful. Unlike much of what we are told during training and professional development, cognitive load theory has real implications for teachers in the classroom that are based on sound evidence derived from robust research designs. Perhaps Dylan Wiliam is onto something. Perhaps cognitive load theory is an important thing for teachers to know.

REFERENCES

Baddeley, A (1992) 'Working memory', *Science*, 255 (5044) pp. 556–559.

Geary, D. C. (1995) 'Reflections of evolution and culture in children's cognition: implications for mathematical development and instruction', *American Psychologist*, 50 (1) pp. 24–37.

Kirschner, P. A., Sweller, J., & Clark, R. E. (2006) '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) pp. 75–86.

Miller, G. A. (1956) 'The magical number seven, plus or minus two: some limits on our capacity for processing information', *Psychological Review*, 63 (2) pp. 81–97.

Shiffrin, R. M. & Nosofsky, R. M. (1994) 'Seven plus or minus two: a commentary on capacity limitations', *Psychological Review*, 101 (2) pp. 357–361.

Sweller, J. (2016) 'Story of a research program', *Education Review*, 23.

Sweller, J. & Cooper, G. A. (1985. 'The use of worked examples as a substitute for problem solving in learning algebra', *Cognition and Instruction*, 2 (1) pp. 59–89.

Wiliam, D. (2017) 'I've come to the conclusion Sweller's Cognitive Load Theory is the single most important thing for teachers to know' bit.ly/2kouLOq [Twitter], 26 January. Retrieved from twitter.com/dylanwiliam/status/824682504602943489

BOLD BEGINNINGS AND THE IMPORTANCE OF RECEPTION

Daniel Muijs

In 2018 Ofsted appointed Professor Daniel Muijs to be its new Head of Research. One of his first publications, *Bold Beginnings*, proved to be an explosive read. In the report, he made recommendations into how the early years curriculum could be improved. Here, he writes exclusively for *researchED* magazine, setting out some of the research that informed the piece.

Early years matter. The Effective Provision of Pre-school Education (EPPE) study, in which the impact of the take-up and quality of early years provision in England was tracked over time, showed that good early education had significant lasting effects across primary schooling (Sylva et al., 2004).

Furthermore, there is evidence that children who fall behind in pre-school do not find it easy to catch up later. Early deficits can persist throughout primary education, meaning children who lag behind in reading and numeracy during pre-school will continue to do so for the rest of their schooling (Olofsson & Niedersoe, 1999; Foorman et al., 1997; Sparks et al., 2014).

This is a particularly important issue in terms of social justice, as children from the most disadvantaged backgrounds are most likely to lack reading or numeracy skills when they enter primary school (Chatterji, 2006). Promisingly, though, there is evidence that attending high-quality pre-school provision can reduce the effect of social background on a child's cognitive development (Hall et al., 2013).

In England, the Reception year is pivotal in providing a bridge between pre-school and the start of formal primary education. So it is should come as no surprise that Ofsted chose to take a closer look at this phase, nor that our resulting report, *Bold Beginnings*, generated widespread interest and indeed some controversy within the sector, not least as we found that the effective Reception providers we visited prioritised reading instruction and early mathematics alongside play-based learning.

One of the criticisms of our report is that it does not take into account the research base on early years education. This is a simplification of the evidence base, which ignores a range of research supporting the balanced approach we advocate in *Bold Beginnings*. In this article I will look at some of this evidence.

### Play matters…but so does the formal teaching of reading and numeracy

Criticisms of *Bold Beginnings* have emphasised the importance of play for early development, not least in developing dispositions for learning, but also in supporting reading and numeracy (*eg* Whitebread & Bingham, 2014).

Bold Beginnings clearly acknowledges the importance of play in Reception, as have previous Ofsted reports such as *Teaching and play in the early years – a balancing act?*

However, there is also clear evidence that, alongside play-based approaches, the formal teaching of reading and numeracy are important, especially for children from disadvantaged backgrounds. Programmes aimed at improving early years education can have long-standing effects, not just on educational attainment but on a range of societally desirable outcomes, such as reduced delinquency and higher graduation rates (Barnett, 2011; Kagan and Hallmark, 2001; Stipek and Ogana, 2000).

For example, a large-scale meta-analysis of 123 comparative studies of early childhood interventions in the US found that attending pre-school (defined as prior to Kindergarten) was positively related to cognitive outcomes and social skills. The study also found that within EY interventions, the use of teacher-led instruction was positively related with cognitive gains (Camilli et al., 2010).

The EPPE study I mentioned earlier showed that effective early years pedagogy included direct teacher instruction. This refers to the provision of instructive learning environments and 'sustained shared thinking',
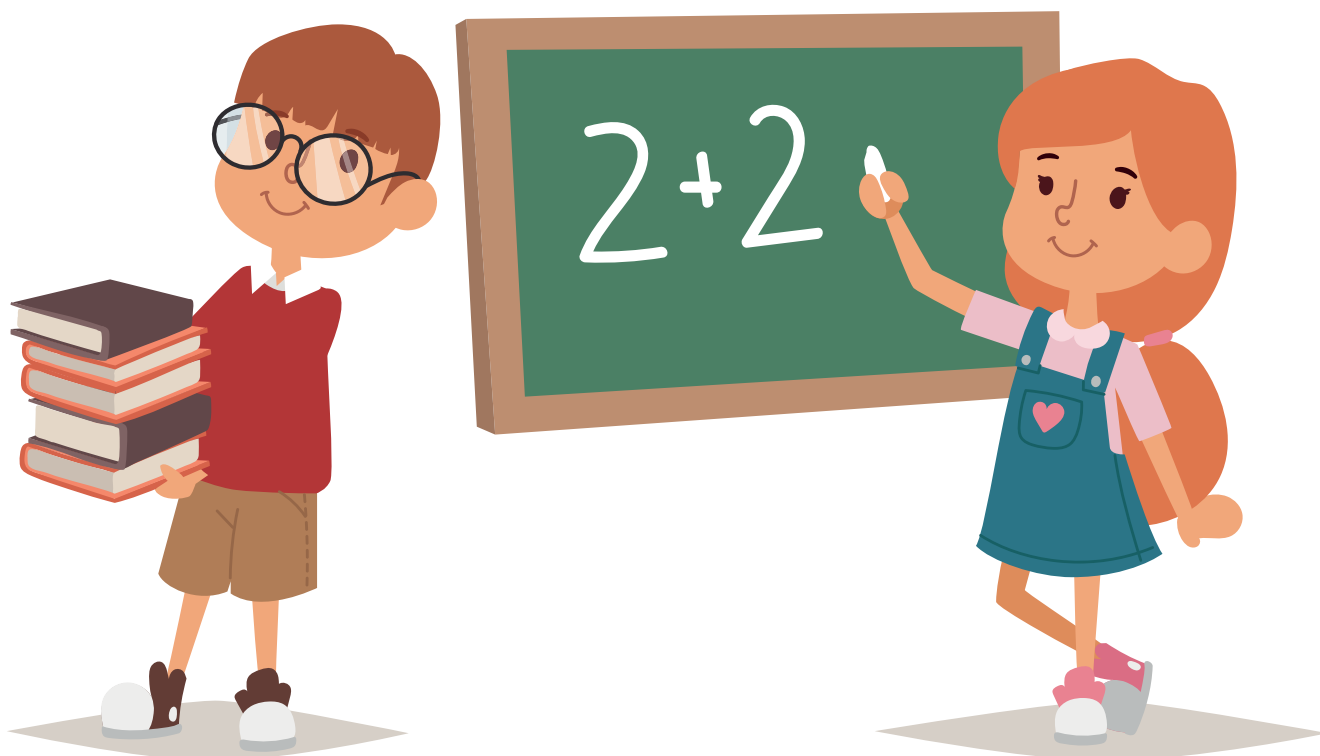
where the child works with an adult to solve a problem (Sylva et al., 2013).

Looking specifically at reading, it is rather depressing to have to continue making the case for systematic phonics instruction when this is possibly the most extensively researched and solidly supported practice in education. Of course, we need to engender a love of reading and literature in children. And authentic texts are important to this, as is reading *to* children, which we acknowledge in *Bold Beginnings*.

However, authentic literature and rich contexts are not a suitable substitute for the explicit teaching of phonics decoding skills. Evidence for this comes from, among many others, the large-scale National Institutes of Health studies in the US, and subsequent evidence reviews from the National Reading Panel (Lyon, 1999; Moats, 1996; NICHD, 2000). These findings replicate across countries, with Hattie (2009), for example, likewise finding strong positive effects of phonics instruction.

There is also evidence that synthetic phonics instruction is particularly effective. In a widely cited study in Scotland, Johnston & Watson (2004) compared the reading skills of children taught using synthetic phonics with those of a group taught using analytic phonics, and found the former to be more effective.

A subsequent study of 10-year-olds whose early literacy programmes had involved either analytic or synthetic phonics methods found that the pupils taught using synthetic phonics had better word reading, spelling, and reading comprehension (Johnston et al., 2012).

Reading instruction should not have to wait until the start of formal schooling. And indeed for many children from middle-class households it doesn't, which is one of the factors that exacerbates inequality. Early phonemic awareness and decoding skills substantially predict later reading achievement, and interventions aimed at improving them are shown to particularly benefit children who struggle with reading (Kendeou et al., 2009; Ehri et al., 2001; Hatcher et al., 2004).

Similar findings emerge from research on numeracy. Early numeracy skills predict attainment in primary school, and the quality of early years provision is one factor that influences early numeracy, alongside experience of counting and numbers at home (Anders et al., 2013; Aubrey et al., 2006; LeFevre et al., 2009).

Another review of 19 studies showed that both formal instruction and play-based activities led to improved numeracy skills (Mononen et al., 2014).

Conclusion
The *Bold Beginnings* study did not explicitly set out to confirm the evidence reviewed above, although it had a clear focus on reading and numeracy. The study underlying our report was an empirical analysis of 41 good and outstanding schools, selected because they performed highly against a range of indicators, including EYFS development levels, the Phonics screening check and attainment at Key Stage 1 (for full details see the technical document).

However, in supporting a balanced approach that includes explicit instruction in reading and numeracy alongside play-based learning, *Bold Beginnings* does corroborate a wealth of research in the field.

REFERENCES

Anders, Y., Grosse, C., Rossbach, H.-G., Ebert, S. & Weinert, S. (2013) 'Preschool and primary school influences on the development of children's early numeracy skills between the ages of 3 and 7 years in Germany', *School Effectiveness and School Improvement*, 24 (2) pp. 195–211.

Aubrey, C., Godfrey, R. & Dahl, S. (2006) 'Early mathematics development and later achievement: further evidence', *Mathematics Education Research Journal*, 18 (1) pp. 27–46.

Barnett, W. S. (2011) 'Effectiveness of early educational intervention', *Science*, 333 (6045) 975–978.

Camilli, G., Vargas, S., Ryan, S. & Barnett, S. (2010) 'Meta-analysis of the effects of early education interventions on cognitive and social development', *Teachers College Record*, 112 (3) pp. 579–620.

Chatterji, M. (2006) 'Reading achievement gaps, correlates, and moderators of early reading achievement: evidence from the Early Childhood Longitudinal Study (ECLS) kindergarten to first grade sample', *Journal of Educational Psychology*, 98 (3) pp. 489–507.

Ehri, L., Nunes, S., Willows, D., Schuster, B., Yaghoub-Zadeh, Z. & Shanahan, T. (2001) 'Phonemic awareness instruction helps children learn to read: evidence from the National Reading Panel's meta-analysis', *Reading Research Quarterly*, 36 (3) pp. 250–287.

Foorman, B. R., Francis, D. J., Shaywitz, S. E., Shaywitz, B. A., & Fletcher, J. M. (1997) 'The case for early reading intervention' in Blachman, B. A. (ed.) *Foundations of reading acquisition and dyslexia: implications for early intervention*. Mahwah, NJ: Lawrence Erlbaum Associates, pp. 243–264.

Hall, J., Sylva, K., Sammons, P., Melhuish, E., Siraj-Blatchford, I. & Taggart, B. (2013) 'Can preschool protect young children's cognitive and social development? Variation by center quality and duration of attendance', *School Effectiveness and School Improvement*, 24 (2) pp. 155–176.

Hatcher, P., Hulme, C. & Snowling, M. (2004) 'Explicit phoneme training combined with phonic reading instruction helps young children at risk of reading failure', *Journal of Child Psychology and Psychiatry*, 45 (2) pp. 338–358.

Hattie, J. (2009) *Visible learning: a synthesis of over 800 meta-analyses relating to achievement*. New York, NY: Routledge.

Johnston, R. S. & Watson, J. (2004) 'Accelerating the development of reading, spelling and phonemic awareness skills in initial readers', *Reading and Writing*, 17 (4) pp. 327–357.

Johnston, R. S., McGeown, S. & Watson, J. E. (2012) 'Long-term effects of synthetic versus analytic phonics teaching on the reading and spelling ability of 10 year old boys and girls', *Reading and Writing*, 25 (6) pp. 1365–1384.

Kagan, S. L. and Hallmark, L. G. (2001) 'Early care and education policies in Sweden: implications for the United States', *Phi Delta Kappan*, 83 (3) pp. 237–245, 254.

Kendeou, P., van den Broek, P., White, M. J. & Lynch, J. S. (2009) 'Predicting reading comprehension in early elementary school: the independent contributions of oral language and decoding skills', *Journal of Educational Psychology*, 101 (4) pp. 765–778.

LeFevre, J.-A., Skwarchuk, S.-L., Smith-Chant, B. L., Fast, L., Kamawar, D., & Bisanz, J. (2009) 'Home numeracy experiences and children's math performance in the early school years', *Canadian Journal of Behavioural Science*, 41 (2) pp. 55–66.

Lyon, G. R. (1999) The NICHD research program in reading development, reading disorders and reading instruction. NICHD: Keys to Successful Learning Summit.

Moats, L. C. (1996) 'Neither/nor: resolving the debate between whole language and phonics.' Lecture given at the 1996 Washington Summit Conference of Learning Disabilities.

Mononen, R., Aunio, P., Koponen, T. & Aro, M. (2014) 'A review of early numeracy interventions for children at risk in mathematics', *International Journal of Early Childhood Special Education*, 6 (1) pp. 25–54.

National Institute of Child Health and Human Development (NICHD) (2000) *Report of the national reading panel: teaching children to read: an evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: reports of the subgroups*. Washington, DC: NIH.

Olofsson, A. & Niedersoe, J. (1999) 'Early language development and kindergarten phonological awareness as predictors of reading problems', *Journal of Learning Disabilities*, 32 (5) pp. 464–472.

Sparks, R., Patton, J. & Murdoch, A. (2014) 'Early reading success and its relationship to reading achievement and reading volume: replication of "10 years later"', *Reading and Writing*, 27 (1) pp. 189–211.

Stipek, D. & Ogawa, T. (2000) 'Early childhood education' in Halfon, N., Shulman, E. & Shannon, M. (eds) *Building community systems for young children*. Los Angeles, CA: UCLA Center for Healthier Children, Families and Communities.

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I. & Taggart, B. (2004) *The effective provision of pre-school education (EPPE) project*. Nottingham: Department for Education and Skills.

Whitebread, D. & Bingham, S. (2014) 'School readiness: starting age, cohorts and transitions in the early years' in Moyles, J., Georgeson, J. and Payler, J. (eds) *Early years foundations: critical issues*. 2nd edn. Maidenhead: Open University Press, pp. 179–191.

researchED BIRMINGHAM: AN UNEXPECTED JOURNEY

Why and how I set up #rEDBrum, February 2018

Claire Stoneman
@stoneman_claire
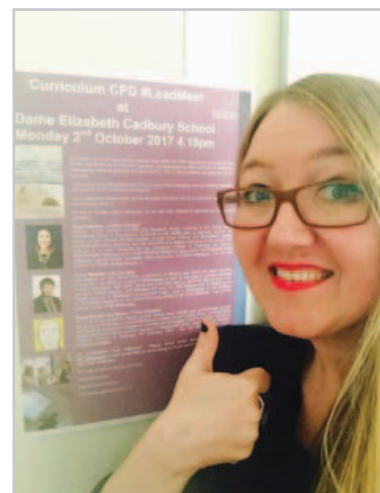
I began to understand the world of edu-Twitter about 18 months ago. I had no idea what a hashtag was. Twitter handles were an alien concept. I was oblivious to arguments about whether pupils should face boards or windows; I was puzzled about what gazing at trees could teach my kids about symbolism in *Dr Jekyll and Mr Hyde*, or the nuances of monosyllabic metre in Shakespeare unless Ents were rapping at the panes. And even then, I wasn't sure their explanations would be clear enough. Such was the influence of Twitter. So it wasn't just me who thought pupils should face the board! Huzzah! Suddenly I'd found comrades-in-arms, like Rebecca Foster (@TLPMsF).

Now my emergent understanding of Twitter meant that I became more familiar with the 'ED' noun-into-verb suffixes that punctuated Twitter. These ED groups and opinions are prolific, and full of strong opinions. Opinions and experiences are important, but sometimes we wander into the apple-bobbing land of Teaching Folklore. This can often be a wonderful place to be, but a tricky place to navigate. Folklore, though pretty, can trip you up.

And, Twitter, with great power comes great responsibility. In navigating the waves of voices and choppy opinions in my exciting 'Twitter Voyage' for the Holy Grail of understanding, I found one welcoming community of people, not all of whom agreed with each other, but with a common purpose: researchED.

I began with a small team of researchED enthusiasts at my school. They devoured research, attended as many researchEDs as they could, even Skyped with the 'Master Magician of Visualising Teaching Concepts', Oliver Caviglioli. Momentum grew. And with that, so did the outcomes of our pupils. Our English results in 2017 were the best they'd ever been; our history results improved

twofold. This wasn't a happy accident. Those heads of faculty had engaged with research, and had tailored teaching in their faculties in response to this. I salute you, Rekha Dhinsa, Rachael Atton, Tom Hutton.

So to the 'how'. Much as I like maypoles and bunting, the Fayre of Teaching Folklore didn't appeal. What did, though, was establishing the first-ever researchED Brum. There'd been one a few years back in the outskirts in Solihull, but never one here, in Middle Earth itself. I put it to Tom Bennett, who let me run with it.

I was incredibly grateful for the 'been there, done that' wisdom of other researchED organisers, like #rEDRugby's sagacious Jude Hunton. Ever-patient with my frantic DMs at 11pm ('How do I make Eventbrite do this?'), along with providing an immense #rEDRugby model to work from, his researchED cup runneth over. I had a model, and like any Rosenshine disciple knows, this is a Good Thing.

I got stuck in. First thing was to arrange a date. I did that with Tom, and with my headteacher. This was back in the hazy days of July 2017. We agreed February 2018. It was only in the December snow days that I started to lose sleep about it. Would it be snowed off? Too late, it was happening. I'd booked lunch, I'd booked site team for the day, but I hadn't booked snow ploughs. Gutted.

I began booking speakers in August. For researchED, the work presented has to be grounded in evidence, from published work to case studies. This made sense. Everyone was unquestionably generous. researchED is grass roots. One way we try to keep ticket costs as low as possible is by speakers not being paid a penny; some even contribute their travel expenses – amazing really. And democratising, too: it means you can access fantastic

professional development without forking out a fortune. It's accessible, and it's cheap. Another Very Good Thing.

When organising researchED, there are a few things you have to remember. Things like getting the space right, like having good IT support, like a supportive SLT who can calm your rattled nerves. Even whether or not you have enough toilet paper. That was a last-minute thing I had to rectify on the day!

We were grateful at #rEDBrum to have primary, secondary, and ITT colleagues presenting, as well as researchers and other educators. For #rEDBrum19, I'd like governors presenting too; in #rEDBrum they were well-represented as delegates. #rEDBrum was a mix of altruistic, open-minded people. Nearly 70% of ticket buyers were female – researchED is clearly perceived as a supportive space for all. It was important to us that #rEDBrum was accessible to those on parental leave. We encouraged #MTPT colleagues to come along; it was fab to see teachers *and* toddlers enjoying the 'live lesson'!

Miraculously, things just seemed to work on the day. But this wasn't by chance. I tried to ensure our speakers had everything they needed beforehand, that our IT network manager had everything *he* needed beforehand so his life was as easy as possible, that our fabulous prefects knew exactly what to do (I am indebted to our other deputy headteacher, Waris Ali, for this), and that I had a support network of people just to check I was OK. What I didn't

expect were so many generous-hearted delegates and presenters making a point of telling me what a great day they'd had. The vast majority of these people didn't know me personally, or recognise me from Twitter, but they were kind enough to find me and tell me. This typifies everyone I have met that is involved with researchED: kind, thoughtful, generous. I am very proud to be one small part of such a community.

Claire is deputy headteacher for curriculum, assessment, and standards of teaching at Dame Elizabeth Cadbury School, Birmingham. She also line manages English, humanities, a large pastoral house and the lead practitioner team. Claire teaches English and loves it. She is a blogger (www.birminghamteacher. wordpress.com), a writer, and occasionally an opera singer. Claire's interests in education include narratives around teacher wellbeing and the concept of 'authenticity', curriculum development, and the development of middle leaders.

If you have been inspired by Claire's story and want to host a researchED event of your own, get in touch with us at contact@researchED.org.uk.

See pages 22–23 for more information or visit www. researchED.org.uk

THE ONE THING YOU NEED TO READ

For teachers or educators who want to get more evidence-informed, one of the most daunting things can simply be knowing where to start. No one ever said teachers were meant to be researchers, and it's a big field to grapple with. So we asked some people who know something about the landscape what one thing they would recommend other educators should read – and why.
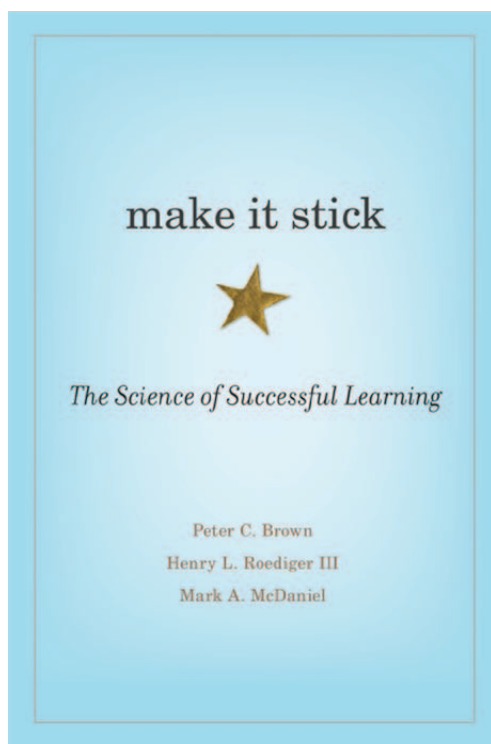
Dr Efrat Furst, postdoctoral fellow and the learning incubator in the school of engineering and applied sciences at Harvard University.

Make It Stick: The Science of Successful Learning by Brown, P. C., Roediger, H. L. and McDaniel, M. A.

'Chapter 1: Learning is Misunderstood'

Why? Choosing one resource is especially hard since a good resource is often appreciated in the context of many others combined with practical experience. This is a reason to read this chapter: it elegantly combines key insights from both research and practice into a coherent and enlightening read. It highlights the decades-long solid evidence for effective learning strategies (the benefits of wide knowledge and effortful practice), as well as an essential review of illusions and psychological barriers (e.g. rereading is not effective but self-deceptive). Last, the chapter includes a collection of concrete recommendations for better learning (e.g. spaced and varied retrieval practice). All in all, the chapter is a valuable 'stand alone' resource, but hopefully also a trigger to read this excellent book from cover to cover. The entire book makes a very strong case for the contribution of the science of learning to teaching and learning, and its takeaways highlight the crucial role that informed teachers may have on students' learning.

Harry Fletcher-Wood, Associate Dean, Institute for Teaching

The Science of Learning by Deans for Impact

Why? This offers a clear, succinct summary of what we do and don't know about learning, alongside guidance which would allow teachers in any subject and age group to use it tomorrow. The paper combines deceptively simple observations – like 'Practice is essential to learning new facts, but not all practice is equivalent' – with ideas about how we can use them – like 'Teachers can interleave (i.e., alternate) practice of different types of content.' It's six pages and can be read in 15 minutes, yet perfecting an approach to applying these ideas in the classroom is a lifetime's work.

Joe Nutt, Education Consultant, researcher and author

Teachers make a difference: what is the research evidence?, paper by Hattie, J.

Why? Because it's one of the only credible pieces of research about excellent teaching I've ever read, and too many teachers – and, more significantly, their leaders – spent their entire careers in schools where they never see excellent teaching.

Mark Enser, Head of Geography at Heathfield Community College

Threshold concepts and troublesome knowledge, report by Meyer, E. and Land, R.

Why? An understanding of these concepts is very important when planning a curriculum – it ensures that content is taught in a way that supports a deeper conceptual understanding.

Naureen Khalid, Governor

Urban Myths about Learning and Education by De Bruyckere, P., Kirschner, P. A. and Hulshof, C. D.

Why? This book looks at various common beliefs and then what research has to say about them. It can be a valuable reference text for teachers (and governors).

Rajvi Glasbrook-Griffiths, Assistant Headteacher

Why Knowledge Matters by Hirsch, E. D.

Why? For holding equity at the heart of educational purpose and putting forward clearly the case for knowledge and cultural capital as a powerful leveller
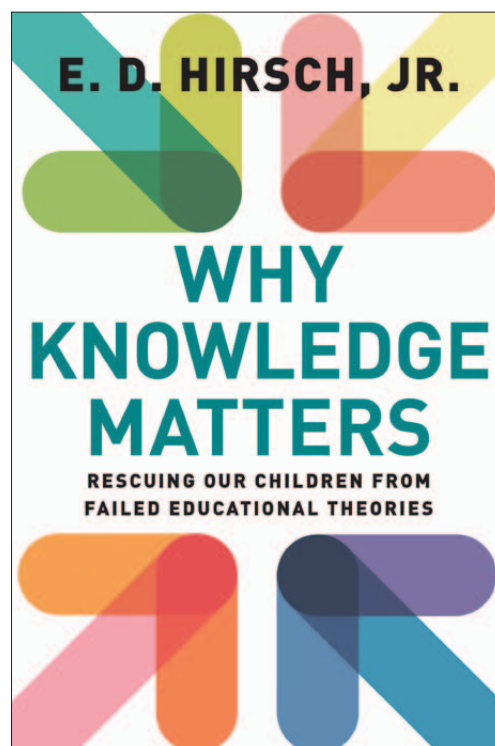
Greg Ashman. Teacher, blogger, and PhD candidate, Australia

'Why minimal guidance during instruction does not work', article in *Educational Psychologist* 41 (2) by Kirschner, P. A., Sweller, J. and Clark, R. E.

Why? Before I read this paper, I felt that I was 'doing teaching wrong'. I believed that it was better for students to figure concepts out for themselves than to have these concepts explained to them. However, I had never had much success at enabling students to figure physics or maths ideas out for themselves so I had developed more of an expository teaching style and I felt guilty about this. Reading this paper was a liberation because I realised that cognitive science was actually on my side and that I had been doing the right thing. It freed me to work on improving what I was doing in a way I had not been able to do before.

Eric Kalenze, author and blogger

Battle Hymn of the Tiger Teachers, edited by Birbalsingh, K.

Why? Though it's not filled with study after study, I think every teacher should read *Tiger Teachers* because it (1) shows a unified group of teachers making educational research work for every part of their school – instruction, climate, professional learning, etc. – and (2) shares how such evidence-informed practices work for kids and all-around school culture. In full, the narratives of teamwork, success, and growth in *Tiger Teachers* don't just tell teacher-readers what they should do, it shows them what they can do.
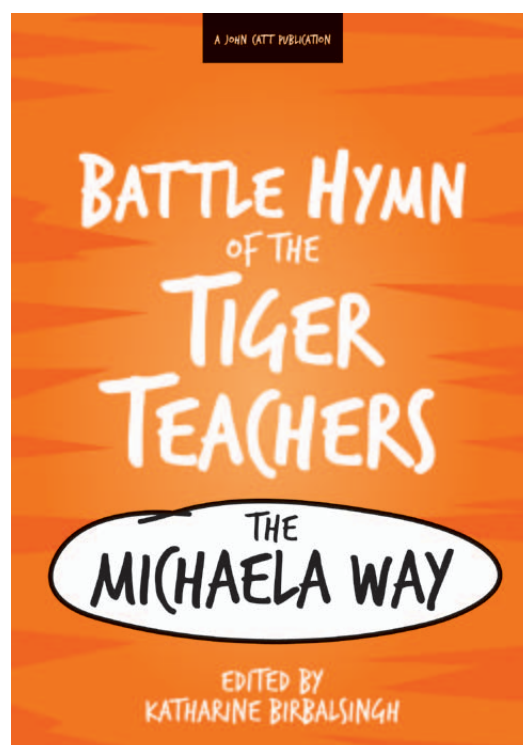
Dr Pedro De Bruyckere, educational scientist at Arteveldehogeschool, Ghent

I couldn't mention my own books, so I'm left with *When Can You Trust The Experts?* by Willingham, D.

Why? While most people would pick *Why Don't Students Like School?* [his previous book], which is great too, this book helps you to become more evidence-informed as a teacher, principal or parent. It will help you for sure when you read every other book that will be mentioned.
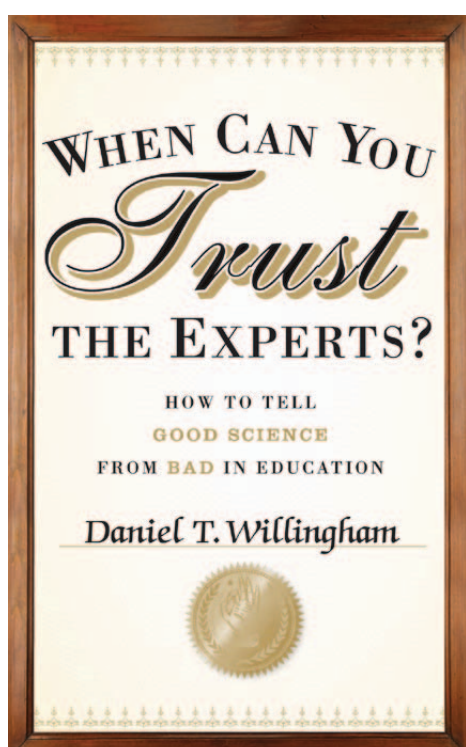
Daisy Christodoulou, Director of Education, No More Marking

Why Don't Students Like School? by Willingham, D.

Why? The clear, relevant and practical application of research to classroom practice.
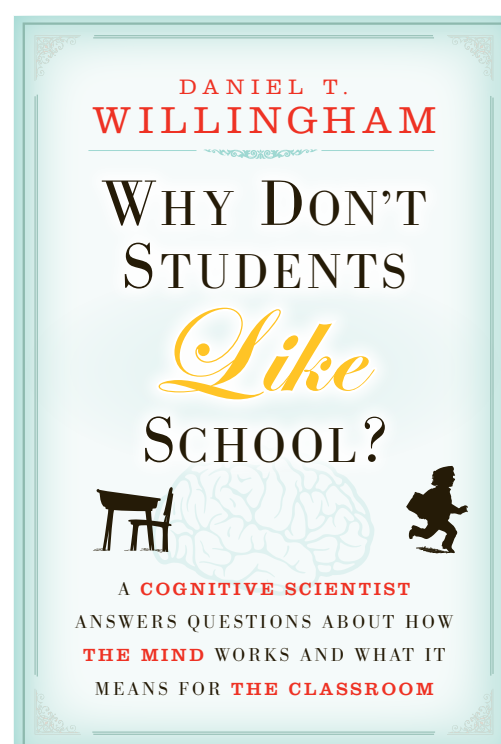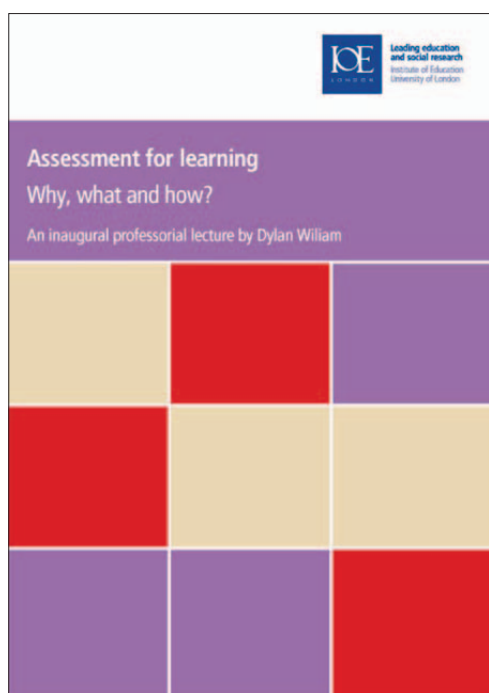
Dr Eva Hartell, STEM teacher

Assessment for learning: why, what and how? by Wiliam, D.

Why? It is a short and easy-to-read booklet on formative assessment, which is supported by loads of research, and found to be beneficial for student learning. However, there is also evidence that shows formative assessment is superficially implemented, so only reading is not enough. I suggest people look at the embedding formative assessment professional development packs by Siobhan Leahy and Dylan Wiliam.

Jude Hunton @judehunton, Headteacher

What if everything you knew about education was wrong? by Didau, D.

Why? It will educate you as a practitioner and a leader. But if you care about edu-literature it becomes a personal pleasure to read. I found it to be the most intellectually enriching and emotionally satisfying edu-book I'd read. You feel that Didau has suddenly leapt miles forwards as a writer and thinker, and he humbly wants you to become better by tooling you up with the scepticism of cognitive science. However he doesn't stop at problematising common sense and winnowing out biases; this wonderful book explains the profoundly important work of Professor Bjork and equips you with how to mobilise your new understanding in your school.
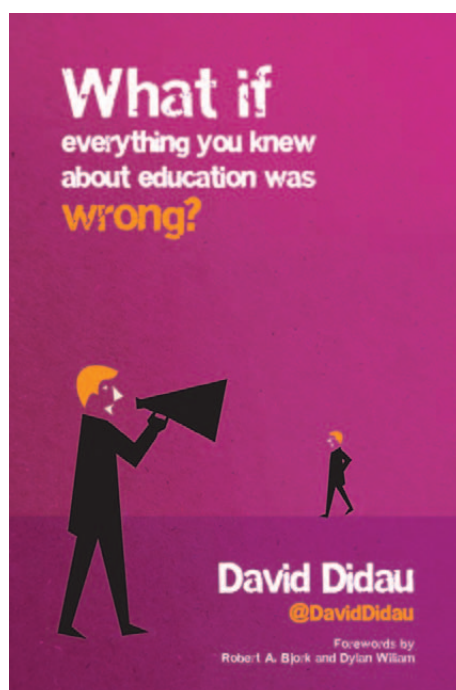
Dr Caroline Creaby, Deputy Headteacher and Research School Director

Student-Centred Leadership by Robinson, V.

Why? This meta study calculated the effect size of different leadership dimensions on student outcomes. In this study, leading teacher learning and development had the greatest impact on student outcomes. This is an important piece of research for school leaders as it highlighted the critical importance of leadership that not only promotes but directly participates with teachers in professional learning. This resonates with me as without it's only when we're directly involved in improving our own practice in the classroom that we can hope to understand the complexities and challenges involved in student learning.

Laura McInerney, Education Journalist and co-founder of Teacher Tapp

Live and Learn by Claxton, G.

Why? In 1984 this was a pioneering book bringing together psychological research and philosophy about the way humans learn. The research has moved on and many educationists would argue this work is now outdated and lacks rigorous, scientific insights. But if one is to understand where evidence-based research is at now, then it's worth looking back at other forms of evidence that have been influential, even if only to understand how times change and to understand how theories maligned today were explained in the past.

Carl Hendrick, English teacher and Director of Research, Wellington College

'Improving students' learning with effective learning techniques', article in *Psychological Science in the Public Interest* 14 (1) by Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J. and Willingham, D.

Why? There is a huge amount of focus on what teachers should be doing and precious little on what students should be doing. In addition, this evidence suggests that most students simply don't know how to study effectively and it also informs what teachers should be doing in the classroom in terms of curriculum and instructional design.

Daniel Muijs, Head of research, Ofsted

'Principles of instruction', article in *American Educator*, 36 (1) by Rosenshine, B.

Why? This paper gives an accessible overview of convergent findings from cognitive science and effective teaching research. The paper clearly shows how findings from the two fields overlap and is a good introduction to the historic work of Rosenshine in effective teaching.

BOOK GIVEAWAY
The Ingredients for Great Teaching

Win one of five copies of Pedro De Bruyckere's new book *The Ingredients for Great Teaching*. To be entered in to the draw to win a copy of this exciting book, simply tweet the hashtag **#Ingredients4Teaching to @SAGEeducation** by 31st July 2018. For competition Ts & Cs visit tinyurl.com/yalplvbw
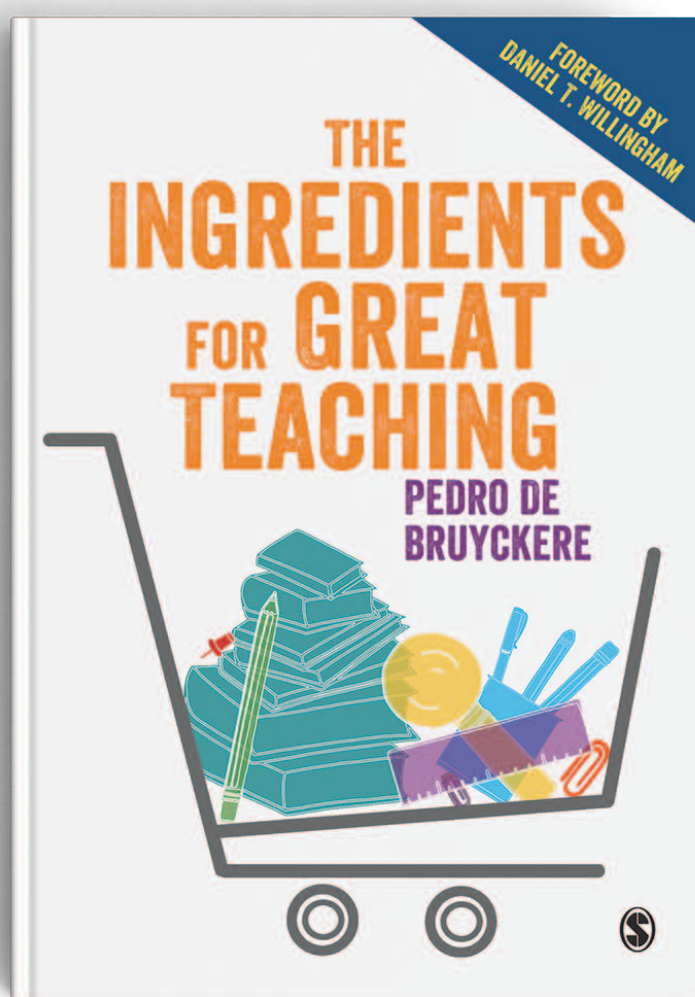
Cambridge Assessment

Celebrating **50** years of research

A *confident future* for our learners

Each and every learner benefits from our research, which is *at the heart* of all our qualifications and education programmes. Across Cambridge Assessment we have a team of more than 80 researchers, which makes our research capability the largest of its kind in Europe. It is this research strength that enables us to help teachers, learners and governments lead the way in education and unlock its power.

Our research is not just about ensuring our qualifications and services are the *very best for learners*. It's also designed to add to knowledge and understanding about assessment in education, both nationally and internationally. We also carry out research for governments and agencies around the world. It's all with one goal in mind – helping learners.

Our research is published in journals in the UK, around the world and on our website:

cambridgeassessment.org.uk/our-research