

## Deliberately difficult – why it’s better to make learning harder : June 10, 2013

*The most fundamental goals of education are long-term goals. As teachers and educators, we want targeted knowledge and skills to be acquired in a way that makes them durable and flexible. More specifically, we want a student’s educational experience to produce a mental representation of the knowledge or skill in question that fosters long-term access to that knowledge and the ability to generalize—that is, to draw on that knowledge in situations that may differ on some dimensions from the exact educational context in which that knowledge was acquired.*

*Robert A Bjork, 2002*

Who could argue with this? Certainly not Ofsted who happily claim in their most recent [Inspection Handbook](#), “The most important role of teaching is to promote learning and to raise pupils’ achievement.” Quite right.

This is, after all, what teaching is fundamentally about. Maybe you have other aims, maybe you consider education to have different purposes, but if we’re not promoting learning and raising achievement what on earth are we doing?

But then they go and spoil it all by boldly stating that outstanding teaching and learning will result in “almost all pupils ... making rapid and sustained progress.”

This statement inevitably begs two questions:

- 1) What does ‘progress in lessons’ look like?
- 2) Can progress be both rapid and sustained?

The one word answers to these questions are:

- 1) Performance
- 2) No

The reason for the confusion is what I’ve termed The Input/Output Myth. We labour under the misapprehension that what we teach, students will learn. Regrettably, the truth is a whole lot more complicated than that.

Graham Nuthall in his marvellously erudite tome, [The Hidden Lives of Learners](#) observes that “as learning occurs so does forgetting”. This is bad enough, but on top of that is the bewildering discovery that most student learning is unique. In the highly structured word of the classroom the ‘items’ learned by no more than 1 other student range from 44.1% to 88.9%. That is to say that on most occasions, well over half of what we teach is not learned by the vast majority of our students. Terrifying! How can we possibly keep track of their progress?

Nuthall suggests that there are 3 different ‘worlds’ at operation in a classroom. There is the visible world of the teacher, the murky, mysterious world of students’ peers, and there’s the rarely glimpsed, private word of the individual student. We get to see our teacher, we get to see the students answering questions and performing task designed to demonstrate their progress but we seldom, if ever, get see inside students’ heads. We literally have NO IDEA what’s going on in there. And any attempt to claim otherwise is foolishness.

So what do we do? We fall back on the comforting sureties on the Input/Output Myth and convince ourselves that students’ performance correlates with their learning. It doesn’t. As Robert Bjork says, “Performance is measurable but learning must be inferred from performance: it cannot be observed directly.”

## What can be done?

If we really want to get a true measure of our students’ progress, promote learning and raise students’ achievement (and we do, don’t we?) than we must do two things:

- 1) Separate performance from learning
- 2) Introduce ‘desirable difficulties’

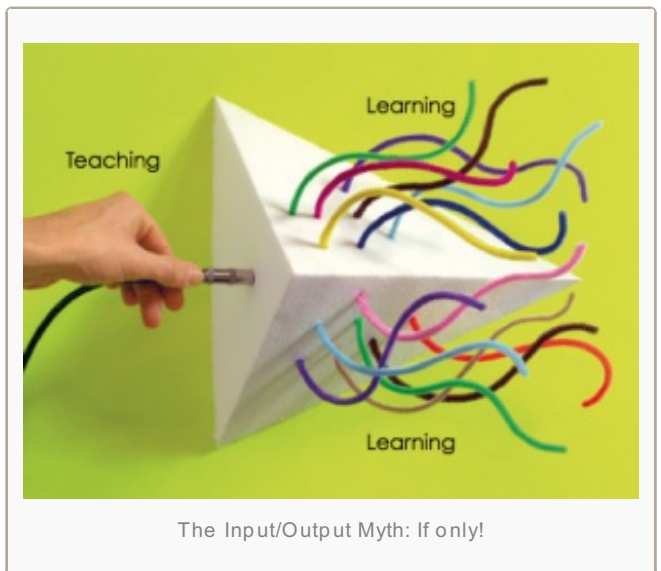
The first is simple. But hard. We need to be weaned from the belief that we can observe progress in 20 minutes, or even a lesson.

| *There is no such thing as progress within lessons. There is only learning. Kev Bartle*

...because...

| *Learning is a liminal process, at the boundary between control and chaos. Dylan Wiliam*

Basically, we must accept that sometimes learning occurs but performance in the short term doesn’t improve, and that at other times, performance may improve, but little learning seems to happen in the long



term.

The second is difficult, but desirably so. I love Bjork's coining, 'desirable difficulties' because it gets to the very heart of the counter intuitive nature of learning. It turns out that making it more difficult for students to learn means that they actually learn more!

If you're after rapid improvement (performance) then you make your teaching predictable, give students clear cues about the answers you're looking for, and do a whole load of massed practice. If you watch *that* lesson it looks great! The teacher is happy, the students are happy and the observer can tick delightedly away at their clipboard. Come back and text them next week, next month, next year and the situation is a little more bleak.

On the other hand, if you after sustained improvement (learning): then you want to introduce as much variability into your teaching as possible; change rooms, change seating, change displays: remove the comforting and familiar background to lessons, and introduce spacing and interleaving to [redesign your curriculum](#). These 'desirable difficulties' will slow down performance but lead to long term retention and (Daniel Willingham's Holy Grail) transfer of knowledge between domains.

But therein lies the problem: everyone prefers the feeling of 'rapid progress'. The route to sustained progress feels uncomfortable. We have to delay gratification. We have to take the risk that an observer won't tick the p'progress' box on their observation pro forma. We might look bad. So we don't do it.

But let's assume that you're willing to take the risk. What would it look like?

Here's a list of suggestions:

- Spacing learning sessions apart rather than massing them together
- Interleaving topics so that they've studied together rather than discretely
- Testing students on material rather than having them simply restudy it
- Having learners generate target material through a puzzle or other kind of active process, rather than simply reading it passively
- Varying the settings in which learning takes place
- Making learning material less clearly organised
- Using fonts that are slightly harder to read

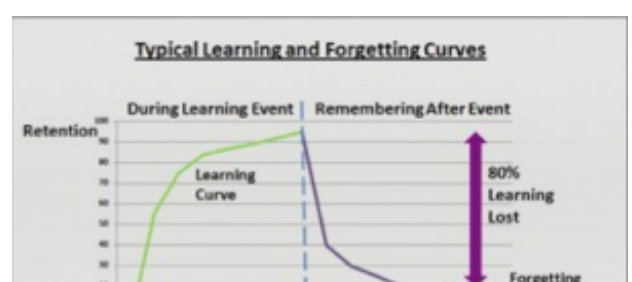
What all these difficulties have in common is that they encourage a deeper, more complex processing of material than people would normally engage in which makes information more likely to transfer from working to long term memory.

## Spacing

Some of these difficulties don't seem so bad. [Ebbinghaus](#) was banging on about his 'forgetting curve' over a century ago and spacing is one of the most widely accepted facts about how the human mind learns.

The first graph shows the unsurprising fact that after we learn a piece of information we start to forget it. The longer we leave it, the more likely it is that the memory 'decays' and we forget. This is the Theory of Disuse.

It makes complete sense that if we revisit this information at regular intervals we are much more likely to remember it. The only problem with this as teachers is the kids



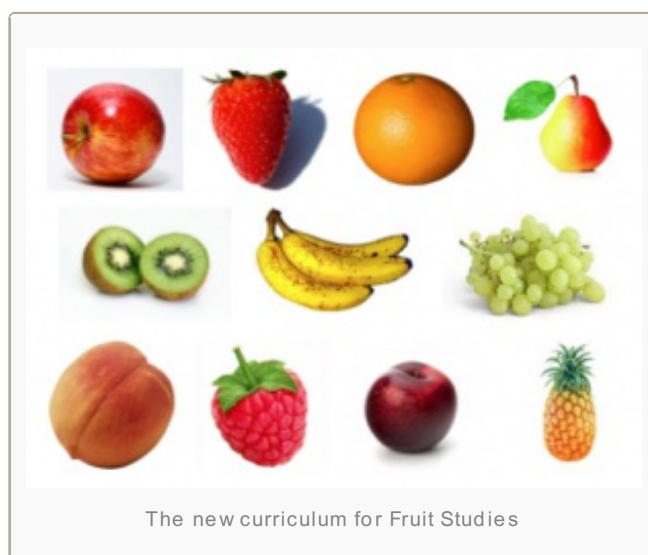
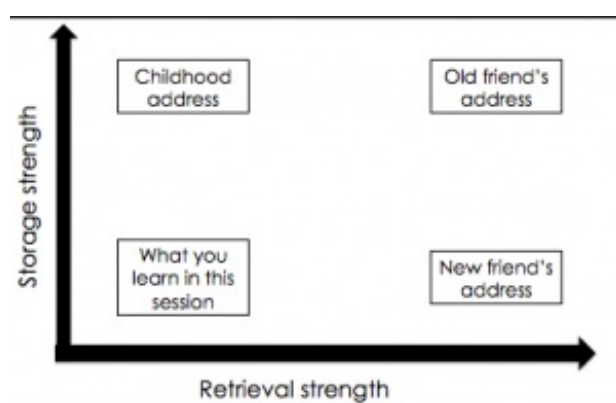
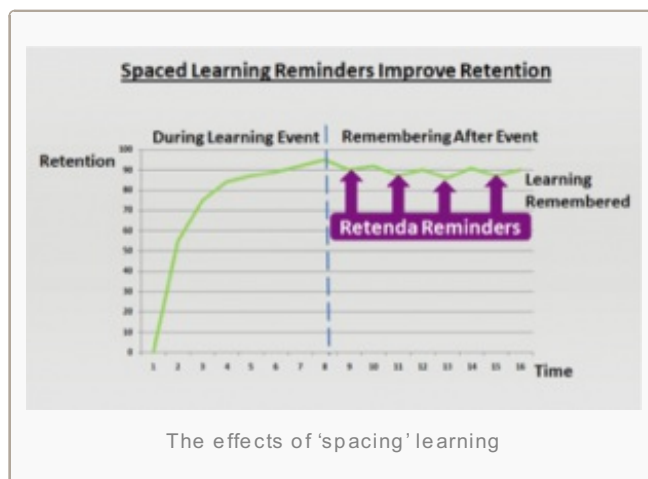
perpetual moan that they've "done this before". As with all things pedagogical if you explain why you're doing what you're doing, all should be well.

But that's all too easy for Bjork. He's come up with what he rather unimaginatively calls the [New Theory of Disuse](#). This suggests that memory doesn't decay, instead we become less able to retrieve the information we've stored. The difference might sound pedantic, but actually it's quite exciting. It means that the storage capacity of human memory is, for all practical purposes, limitless. Bjork argues that each item we commit to memory has a 'storage strength' and a 'retrieval strength'. Some things, like the address of a friend you've been visiting for years as both high storage and retrieval strengths as we're continually using the information. But if they suddenly move house their new address will have low storage strength because we haven't known it long but its retrieval strength will be quite high as we continually review the address so as not to forget it. Other information like the address we lived at as a child has high storage strength as we've known it forever, but low retrieval strength because we don't think about it very often. This accounts for our frustrating inability to suddenly be unable to recall stuff we *know* we know. And then there's the stuff you've just taught your Year 9s. That has low storage because they've only just learned it *and* low retrieval strength because they've never tried to recall it.; the lower the storage strength, the more quickly retrieval strength fades. No wonder they forget it so quickly!

Making learning easier causes boosts retrieval strength in the short term but because the deeper processing that encourages the long-term retention is missing, that retrieval strength quickly evaporates.

## Generation

Another desirable difficulty we can introduce is to get students to 'generate' information instead of just reading it. If I wanted you to learn the names of a load of fruit, I could ask you to simply read and recall their names, or I could give you a prompt such as 'or \_\_\_\_' and 'orange' would immediately come to mind. This results in 'retrieval induced forgetting'; when retrieving information from memory the retrieved memory will be strengthened. However, competing memories will be less accessible afterwards. This implies that remembering doesn't only produce positive effects for the remembered facts or events, but it might also lead to forgetting of other, related things in memory. Unsurprisingly, over the short term you would remember those items you had generated much better than those you hadn't. But weirdly, as we forget, we free up space for new learning. If we don't forget we limit our ability to learn. So we actually *want* students to forget some stuff! When learning is difficult, people make more mistakes, and, naturally, they infer that what they're doing must be wrong. In the short



term, difficulties inhibit performance, causing more more mistakes to be made and more apparent forgetting. But it is this forgetting that actually benefits students in the long term; relearning forgotten material takes demonstrably less time with each iteration.

## Interleaving

Another difficulty we might want to introduce is interleaving our curricula. This means that instead of delivering topics in the traditional termly blocks, we instead work out in advance the information we need students to learn over the duration of a course and mix it up so that in any given term they might study 6 or 7 different topics.

This is maybe more straightforward in a 'skills based' subject like English but may look very daunting for teachers of maths or science. If you deliver your course in blocks students' performance will be much higher at the end of a term. But if you interleave your curriculum their learning will be much deeper at the end of the course. Blocking leads to short term gains but they're deceptively compelling; it *feels* right to do teach this way.

But why is this? What happens in our brains when we "mass" versus "interleaf" our learning? Bjork speculates that blocking gives us a false sense of security; we *think* we're getting better. In contrast, interleaving creates anxiety; the feeling things are unpredictable, and that therefore we need to take more care.

## Testing

Possibly the most surprising difficulty is that of testing. Bjork refers to 'the illusion of knowing' (which is really just a more poetic way of describing counter-intuition.) We think we know more than in fact we do. For instance you may well have some pretty fixed ideas about testing. Which of these study patterns is more likely to result in long term learning?

1. study study study study – test
2. study study study test – test
3. study study test test – test
4. study test test test – test

Most of us will pick 1. It just *feels* right, doesn't it? Spaced repetitions of study are bound to result in better results, right? Wrong. The most successful pattern is in fact No. 4. Having just one study session, followed by three short testing sessions – and then a final assessment – will out perform any other pattern. Who knew?

But this doesn't mean we need more summative assessment. What it suggests is that we should use testing as part of our teaching and learning repertoire. Until very recently, this was something that, quite literally, never occurred to me. Bjork's advice is to make testing experiences low risk, frequent, and designed to include variation and distracting difficulties. such as providing competing alternative answers to trigger retrieval of information that might be tested at another opportunity.

I don't know about you, but this stuff makes my head reel.

The message is don't trust your gut. If feels right, it's probably wrong. Easy isn't actually easier. Deliberately choose the harder, more difficult option. Learning isn't easy. But as Hattie reminds us, "A teacher's job is not to make work easy. It is to make it difficult."

## Related posts

The problem with progress [Part 1](#), [Part 2](#) and [Part 3](#)

## [Easy vs Hard](#)

And, if you're into a spot of research, try this: [Introducing Desirable Difficulties for Educational Applications in Science](#)

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