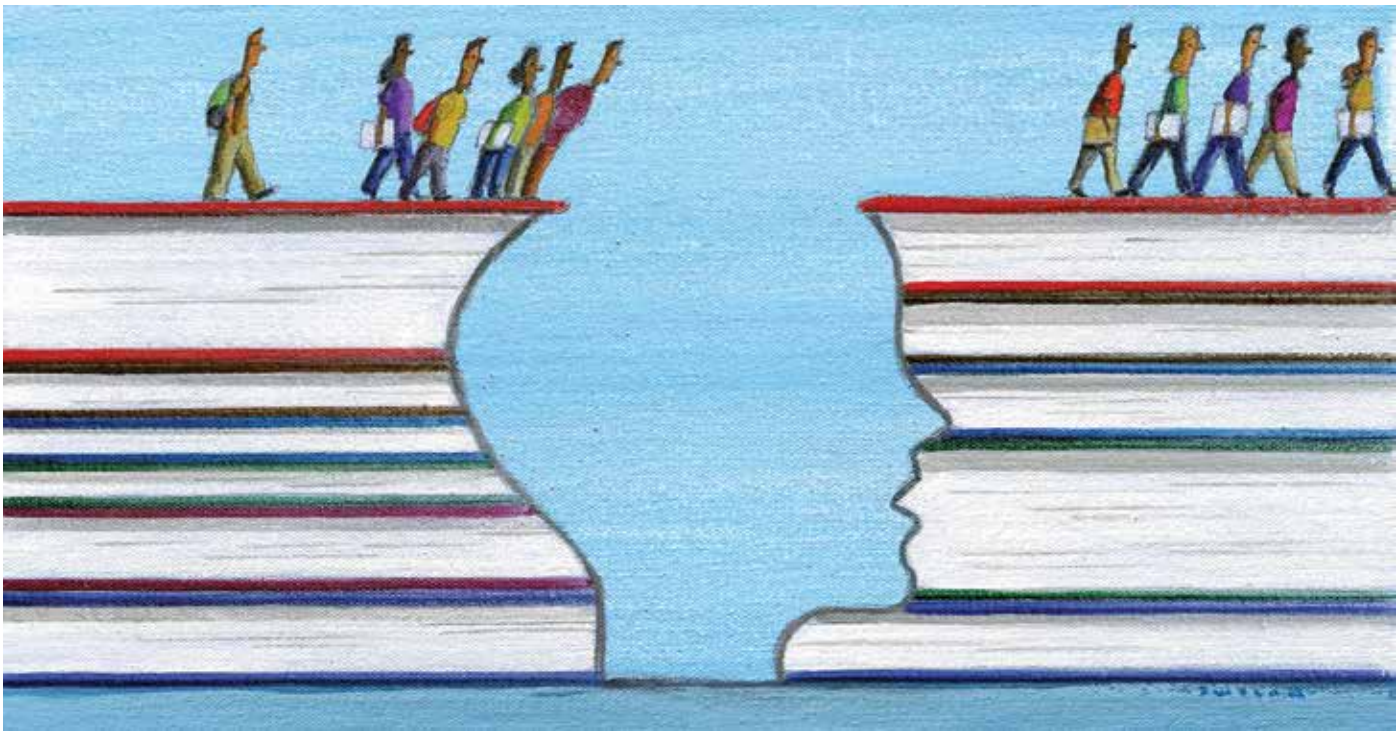
Minding the Knowledge Gap

The Importance of Content in Student Learning



By Daisy Christodoulou

In 2007, I trained as a teacher and started teaching English in a secondary school in Southeast London that enrolls students between the ages of 11 and 18. One of the first things that struck me when I was teaching was that my pupils seemed to know so little. Even the bright and hard-working pupils seemed to me to have big gaps in their knowledge.

Before I became a teacher, I'd read newspaper articles about pupils lacking knowledge, but I had always assumed these reports had been exaggerated by the media. I wondered if my experiences were unusual, but the experiences of colleagues at other schools seemed similar to mine. Pupils who didn't know where milk came from, who didn't know the name of the British prime minister, who could barely name any foreign countries, and who had no idea of when important world-changing technologies had been invented.

I started researching the issue, and I found that my experiences weren't atypical. I also found that many American teachers had the same experiences. For example, there's a study showing that two-thirds of Americans can't name the three branches of the United States government.[1] In the United Kingdom, there's a study showing that a third of pupils think the House of Lords is elected.[2] It isn't—I know this tends to surprise a lot of Americans and others from more democratic countries, but it shouldn't really come as a shock to U.K. citizens!

In a lot of the training material I read, these knowledge gaps were given very little attention. Generally, the word "knowledge" was used in a very pejorative way. The idea was that you were supposed to focus on skills like analysis, evaluation, synthesis, and so forth. Knowledge was the poor relation of these skills. Of course, I wanted my pupils to be able to analyze and evaluate, but it seemed to me that a pupil needed to know something to be able to analyze it. If a pupil doesn't know that the House of Lords isn't elected, how can you get him to have a debate or write an essay analyzing proposals for its reform? Likewise, if a pupil doesn't know what the three branches of government are in the United States, how can she understand debates in the papers about the Supreme Court striking down one of Congress's laws?

I was also influenced here by my own background. I was born in East London to a working-class family. My father's parents were immigrants from Italy and Cyprus. My father said that when he was in school as a child in England, he very often felt as though he was on the outside of a conversation. He didn't know what the conversations were about, and he couldn't go home and ask his parents because they didn't know either. He was very determined that I wouldn't have that experience, and I didn't want my pupils to have that experience. Middle-class children pick up a lot of knowledge from home, from books, from programs on the radio, and so forth. Working-class children and the children of immi-

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ILLUSTRATIONS BY PAUL ZWOLAK

grants don't always get those advantages. A lot of the pupils I taught were just as bright and hard-working as the pupils at private schools, but they lacked crucial knowledge, and this deficit held them back in their studies.

As I researched these issues, I stumbled across this publication, *American Educator*, the quarterly journal of the American Federation of Teachers. Two articles in particular resonated with me at this point—one by Gilbert Sewall and one by Vincent Ruggiero.* Sewall's article detailed lots of examples of lessons that focused on trivial activities. I had seen lessons exactly like these in English classes, and in fact I'd taught some like that myself, with predictably underwhelming results. Ruggiero's article was more about discipline, but it was also making what I felt was a very important point about the transmission of knowledge.

It was thanks to *American Educator* that I heard of E. D. Hirsch Jr. and Daniel T. Willingham.† I would never have heard of them otherwise. I studied some American education scholars in my training course, so it wasn't that my training course was parochial. But certain ideas and people were just not taught. It was a great relief to read Hirsch and Willingham and to realize that the intuitions I'd had about the importance of knowledge were backed up by solid evidence. But it was also extremely frustrating, because I just couldn't believe that all this vitally important evidence about how pupils learn hadn't been taught to me when I was training to be a teacher.

Unfortunately, there is an unhelpful ideological component to these debates in the United Kingdom. Too often, people think that teaching knowledge is somehow right wing and elitist. But this isn't the case. The kind of powerful knowledge that's in the Core Knowledge‡ curriculum in the United States doesn't "belong" to any class or culture. The great breakthroughs of civilization were made by a whole range of people from different classes and cultures, and if they belong to anyone, they belong to humanity. Teaching these insights to children isn't elitist—not teaching them is!

From my research, I think the U.K. and U.S. systems have a number of things in common. Pupils in both countries lack knowledge of important fundamentals. Both education establishments downplay the importance of knowledge. There is general academic underachievement despite a multiplicity of reform efforts and relatively generous funding. Attention is paid to school structures over classroom practice. And the high-stakes, test-based accountability systems in both countries have, by and large, failed. Let me be clear about this final point, because when I advocate teaching knowledge, people assume I'm advocating high-stakes tests. That isn't at all the case. In fact, I'd argue that a lot of the damaging test preparation we see in both systems is the result of the misconception that skills can be developed in the abstract.

The aim of fact learning is to learn several hundred facts, which taken together form a schema for understanding the world.

I read a lot of books when I was training to be a teacher that seemed to me to be fairly abstruse. I was never quite sure how their theoretical insights were meant to transfer to classroom practice. Likewise, I would read a lot of theoretical articles that would say things like, "Of course this isn't to say that we shouldn't teach knowledge." But then you would finally work out what they were recommending in practice and see that, in fact, it did involve not teaching knowledge. So in my work, I always try to relate everything back to practice in the hope that this will make my argument clearer. I also hope that this will make my observations relevant to classroom teachers from any country, even if they end up disagreeing with the argument.

Last September, after teaching English in two different secondary schools, I started working at ARK (Absolute Return for Kids) Schools, which runs a network of high-performing schools in disadvantaged areas. I work on curriculum and assessment research. I left the classroom because I really wanted to focus on creating curricula and assessments that would help pupils learn, and ARK was the best place for me to do this. There isn't anything like Core Knowledge in the United Kingdom, and we are only just beginning to realize the importance of knowledge and to design curricula that take this into account. ARK Schools is pioneering a really innovative and thoughtful approach to curriculum

*For more about these articles by Gilbert Sewall and Vincent Ruggiero, see *American Educator*'s Summer 2000 issue at www.aft.org/newspubs/periodicals/ae/summer2000.
†For more on E. D. Hirsch Jr.'s and Daniel T. Willingham's work, see *American Educator*'s authors index at www.aft.org/newspubs/periodicals/ae/author.cfm.
‡For more on Core Knowledge, see "Informative, Not Scripted: Core Knowledge Shows How Clear, Specific Content Supports Good Instruction" in the Spring 2008 issue of *American Educator*, available at www.aft.org/pdfs/americaneducator/spring2008/coreknowledge.pdf, and "More Than Words: An Early Grades Reading Program Builds Skills and Knowledge" in the Fall 2012 issue of *American Educator*, available at www.aft.org/pdfs/americaneducator/fall2012/dubin.pdf.

design, and it is also backing it up with excellent teacher training and professional development. ARK is very much focused on improving classroom practice, using data and assessments intelligently, and learning from the best school systems from around the world. The ARK network has a lot of people who have taught in challenging schools working on these projects, so the lessons are designed with real pupils and teachers in mind. It has already created an excellent mathematics curriculum, called Mathematics Mastery, which is based on Singapore Math and is being taught by lots of schools outside the ARK network. I am working on a new English curriculum for ARK Schools, as well as a new assessment system. I do plan to return to teaching so I can use these curricula and assessments myself.

In the meantime, I've written a book, from which this article is drawn, about all that I've learned from my research. In my book, I focus on what I identify as seven myths, or widely held beliefs, that dominate our educational practice. I start with the myth that teaching facts prevents understanding, because this (along with my second myth, that teacher-led instruction is passive) is the foundation of all the other myths I discuss. These myths have a long pedigree and provide the theoretical justification for so much of what goes on in schools. Taken together, all seven myths actually damage the education of our pupils. But here, let's focus on facts and the role knowledge has in our understanding.

Myth: Facts Prevent Understanding

Perhaps the earliest expression of the idea that learning facts will not bring true understanding came from the Swiss philosopher Jean-Jacques Rousseau in the 18th century. In *Émile, or On Education*, he advises that you should "give your scholar no verbal lessons; he should be taught by experience alone."[3] The reason for this, he wrote, is that learning facts is ineffective: "What is the use of inscribing on their brains a list of symbols which mean nothing to them?"[4] Pupils might be able to repeat exactly what you have told them, Rousseau said, but they will not be able to use the facts they have been told or understand how those facts can be deployed in different ways:[5]

> You tell me they acquire some rudiments of geometry, and you think you prove your case; not so, it is mine you prove; you show that far from being able to reason themselves, children are unable to retain the reasoning of others; for if you follow the method of these little geometricians you will see they only retain the exact impression of the figure and the terms of the demonstration. They cannot meet the slightest new objection; if the figure is reversed they can do nothing.

Rousseau thought that such fact learning was not only ineffective but also immoral. In rendering pupils passive, he wrote, it not only ensures they are not learning, it ensures they are having all the joy and excitement of childhood knocked out of them:[6]

> No, if nature has given the child this plasticity of brain which fits him to receive every kind of impression, it was not that you should imprint on it the names and dates of kings, the jargon of heraldry, the globe and geography, all those words without present meaning or future use for the child, which flood of words overwhelms his sad and barren childhood.

In the late 19th century, John Dewey also emphasized the importance of learning through experience. Rousseau thought the child "should be taught by experience alone"; the phrase most commonly associated with Dewey is "learning by doing." For Dewey, the problem with many of the schools in his time was that the pupils were not active:[7]

> The child is thrown into a passive, receptive or absorbing attitude. The conditions are such that he is not permitted to follow the law of his nature; the result is friction and waste.

We see it again: teaching facts makes pupils passive; making pupils passive means they must ignore their natural inclinations; ignoring their natural inclinations makes them unhappy and does not help them learn. And again, the problem is with teaching facts to pupils:[8]

> We present the child with arbitrary symbols. Symbols are a necessity in mental development, but they have their place as tools for economising effort; presented by themselves they are a mass of meaningless and arbitrary ideas imposed from without.

Paulo Freire was a Brazilian educator whose most famous book, *Pedagogy of the Oppressed*, was written in 1968. Like Dewey, his theories have enjoyed great influence: *Pedagogy of the Oppressed* has sold more than one million copies worldwide.[9] It was undoubtedly more popular in its 1970s heyday, but a measure of its continuing influence is revealed by the fact that it came in 10th in a 2007 survey to find the most inspirational education books.[10] In his book, Freire criticizes how facts prevent pupils from truly understanding the reality around them:[11]

Teaching facts and subject content are part of the true aim of education, not in opposition to it.

> The teacher … expounds on a topic completely alien to the existential experience of the students. His task is to "fill" the students with the contents of his narration—contents which are detached from reality, disconnected from the totality that engendered them and could give them significance.

He developed his famous "banking" concept of education, illustrating how facts prevent understanding:[12]

> Education thus becomes an act of depositing, in which the students are the depositories and the teacher is the depositor. Instead of communicating, the teacher issues communiqués and makes deposits which the students patiently receive,

memorise, and repeat. This is the "banking" concept of education, in which the scope of action allowed to the students extends only as far as receiving, filing, and storing the deposits. They do, it is true, have the opportunity to become collectors or cataloguers of the things they store. But in the last analysis, it is the people themselves who are filed away through the lack of creativity, transformation, and knowledge in this (at best) misguided system.

All these metaphors should remind us of another famous writer on education, Charles Dickens. Although Dickens was a novelist, not an education expert, his works and characters are so famous and influential that they merit mention here. His depiction of Thomas Gradgrind's school at the start of *Hard Times* is a literary masterpiece:[13]

> Now, what I want is, Facts. Teach these boys and girls nothing but Facts. Facts alone are wanted in life. Plant nothing else, and root out everything else. You can only form the minds of reasoning animals upon Facts: nothing else will ever be of any service to them. This is the principle on which I bring up my own children, and this is the principle on which I bring up these children. Stick to Facts, sir! …
>
> The speaker, and the schoolmaster, and the third grown person present, all backed a little, and swept with their eyes the inclined plane of little vessels then and there arranged in order, ready to have imperial gallons of facts poured into them until they were full to the brim.

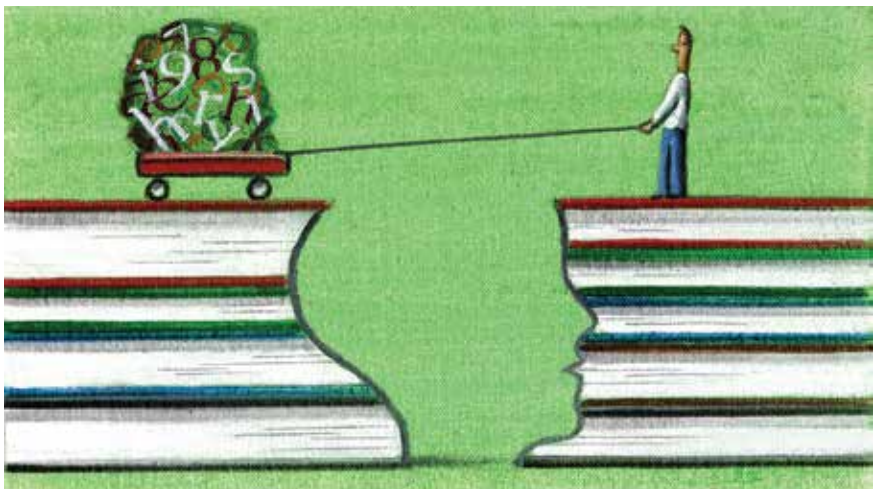
a teacher or anyone involved in education to Gradgrind is an insult, suggesting that the teacher is both emotionally stunted and doing great emotional damage to his or her pupils.

One common trope is seen in all of these writers. They all set up polar opposites between facts, which are generally seen as bad, and something else, which is generally seen as good. Facts are opposed with meaning, understanding, reasoning, significance, and, in Dickens's case, fancy, or what we might today call imagination or creativity. If you want pupils to understand the true meaning of something, to be able to reason, and to be creative and imaginative, then facts are not the way to achieve such an aim.

Why Is It a Myth?

My aim here is not to criticize true conceptual understanding, genuine appreciation of significance, or higher-order skill development. All of these things are indeed the true aim of education. My argument is that facts and subject content are not opposed to such aims; instead, they are part of it. Rousseau, Dewey, and Freire were wrong to see facts as the enemy of understanding. All the scientific research of the last half-century proves them wrong. The modern bureaucrats and education experts who base policy and practice on their thinking are wrong too, and with less excuse, as they have been alive when evidence that refutes these ideas has been discovered. Rousseau was writing in the 18th century; Dewey at the turn of the 20th; Freire in the 1970s. Research from the second half of the 20th century tells us that their analyses of

Factual knowledge is closely integrated with creativity, problem solving, and analysis. It allows these skills to happen.



As we can see, the metaphor at the end has very much in common with those metaphors used by Rousseau, Freire, and Dewey. Dickens criticizes those people who would view children as passive receptacles to be filled with facts. The rest of the novel makes it clear what happens to children subjected to Gradgrind's methods. They turn into emotionally stunted and broken adults, like his daughter Louisa, or into emotionless, heartless snitches like Bitzer. *Hard Times*, incidentally, ranked seventh in the poll previously mentioned on inspirational education books. It is also striking to note how often the name Gradgrind is mentioned in serious discussions on education. The United Kingdom's current affairs program "Newsnight" recently used a lengthy clip of a TV version of *Hard Times* to illustrate a feature on exam reform.[14] Comparing factual learning are based on fundamentally faulty premises.

Much of the modern research into human intelligence was inspired and informed by research into artificial intelligence. To construct a machine that could think, scientists needed a better understanding of how humans actually thought.[15] One of the pioneers in this field, Herbert Simon, gained much of his insight into how humans think through his attempts to construct a thinking machine.[16] In the 1960s and 1970s, researchers agreed on a basic mental model of cognition that has been refined and honed since then.[17] What this model shows is that the facts we have in long-term memory are vitally important for cognition.

By understanding how the brain works, we can understand why this is so. When we encounter a problem we want to solve,

we can use working memory and long-term memory to solve it. "Working memory can be equated with consciousness. Humans are conscious of and can monitor only the contents of working memory. All other cognitive functioning is hidden from view unless and until it can be brought into working memory."[18] So when we want to solve a problem, we hold all the information relating to the problem in working memory. Unfortunately, working memory is highly limited.

There is some debate in the literature about exactly how limited working memory is, but some of the most recent research suggests that it may be limited to as few as three or four items.[19] That is, we can hold only three or four new items in working memory at any one time. This places a huge limit on our ability to solve problems. You can see this by increasing the length of a range of multiplication problems. If you are asked to solve the problem 46 × 7 mentally, then it is possible for you to succeed, because doing so does not require you to hold too much new information in your working memory at once. But there is still a chance you will make errors, because you do have to use your working memory to remember a few things.

You can solve this problem in a couple of ways, but whichever calculation method you use, you have to hold one piece of information in your working memory while you work out the next piece. Then you have to remember the first piece of information because you need to do something that involves using it and the second piece together. It is typical when solving problems like this to forget the result of the first calculation by the time you have got to the end of the last calculation. Multiplying a three-digit number by a one-digit number would test working memory even further. It is not that you do not know how to solve the problem; it is that solving it involves you holding far too many new pieces of information in your working memory at once.

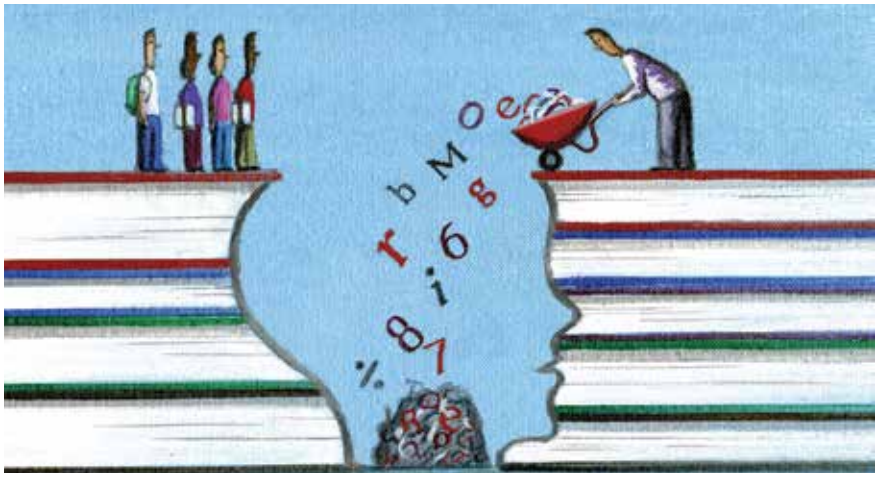
Although working memory is limited, it is possible to cheat its constraints. Our long-term memory does not have the same limitations as working memory. It is capable of storing thousands of pieces of information. We can summon up the information from long-term memory to working memory without imposing a cognitive load. This allows us to cheat the limitations of working memory in lots of ways. For example, we can use the knowledge stored in long-term memory to chunk. If I show you 16 digits for five seconds and then ask you to try to reproduce them, you will probably fail:

4871947503858604

But if I show you the following 16 letters for five seconds, you will probably be able to reproduce them all exactly:[20]

The cat is on the mat.

This is because you have been able to chunk the 16 letters into individual and meaningful words, and then into one individual phrase or sentence. That chunking is dependent on your background knowledge, stored in your long-term memory, of the way that letters form words, the meaning of each individual word, and the typical structure of a sentence.



When the knowledge base is not in place, pupils struggle to develop understanding of a topic.

We can also store rules or processes in long-term memory. These help us to know how to solve a problem. The only reason it is possible for us to solve a problem like 46 × 7 mentally is that we have certain pieces of knowledge stored in memory that help us tackle the problem. We know the process of multiplying a double-digit number with a single-digit number, and we have the relevant knowledge securely committed to long-term memory. Pupils who have not committed the multiplication table to memory cannot solve a problem like that mentally, even if they understand conceptually how multiplication works.

So, when we commit facts to long-term memory, they actually become part of our thinking apparatus and have the ability to expand one of the biggest limitations of human cognition. Professor John Anderson puts it thus:[21]

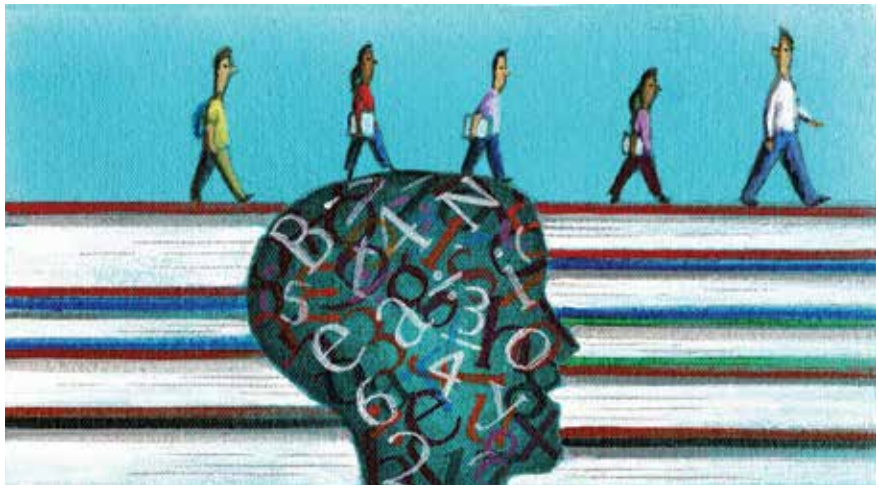
> All that there is to intelligence is the simple accrual and tuning of many small units of knowledge that in total produce complex cognition. The whole is no more than the sum of its parts, but it has a lot of parts.

Long-term memory is capable of storing thousands of facts, and when we have memorized thousands of facts on a specific topic, these facts together form what is known as a "schema." When we think about that topic, we use that schema. When we meet new facts about that topic, we assimilate them into that schema—and if we already have a lot of facts in that particular schema, it is much easier for us to learn new facts about that topic.[22]

Critics of fact learning will often pull out a completely random

fact and say something like, "Who needs to know the date of the Battle of Waterloo? Why does it matter?" Of course, using one fact like this on its own would be rather odd. But the aim of fact learning is not to learn just one fact—it is to learn several hundred, which taken together form a schema that helps you to understand the world. Thus, just learning the date of the Battle of Waterloo will be of limited use. But learning the dates of 150 historical events from 3000 BC to the present day, and learning a couple of key facts about why each event was important, will be of immense use, because it will form the fundamental chronological schema that is the basis of all historical understanding. Just learning that 4 × 4 is 16 will be of limited use. But learning the multiplication table, and learning it so securely that we can hardly not think of the answer when the problem is presented, is the basis of mathematical understanding. If we want pupils to have good conceptual understanding, they need more facts, not fewer.

If we fail to teach knowledge, pupils fail to learn.



For Rousseau, Dewey, and Freire, factual knowledge is seen in opposition to the kinds of abilities and thinking they want to develop. They all identify that teaching facts without meaning is unhelpful. But they all make a further assumption: that teaching facts is therefore opposed to teaching meaning. And this is not true. Factual knowledge is not in opposition to creativity, problem solving, and analysis. Factual knowledge is closely integrated with these important skills. It allows these skills to happen. In a sense, these important skills are the functions of large bodies of knowledge that have been securely committed to memory.

If we want pupils to develop the skills of analysis and evaluation, they need to know things. Willingham puts it this way:[23]

> Data from the last thirty years lead to a conclusion that is not scientifically challengeable: thinking well requires knowing facts, and that's true not just because you need something to think about. The very processes that teachers care about most—critical thinking processes such as reasoning and problem solving—are intimately intertwined with factual knowledge that is stored in long-term memory (not just found in the environment).

Many teachers in the United Kingdom and the United States are familiar with the popular Bloom's taxonomy, which suggests that knowing is a lower-order skill, while analyzing and evaluating are higher-order skills. The metaphor of lower and higher skills leads to two false conclusions. First, it suggests that the skills are somehow separate from knowledge. Second, it suggests that knowledge is somehow less worthy and important. A better metaphor than this is one that is used by Hirsch. He sees the relationship between knowledge and skills as being like a scrambled egg.[24] You cannot unscramble an egg, and you cannot unscramble knowledge and skills. I also like the metaphor suggested by my colleague Joe Kirby, a secondary school English teacher in London, that knowledge and skills are like a double helix, progressing in tandem from surface learning to deep learning. Rather than characterizing fact learning as passive surface learning, and active skill practice as deep learning, we should understand that knowledge and skills are intertwined, and that skill progression depends upon knowledge accumulation.

Perhaps the most fundamental, practical example of how this works is learning the letters of the alphabet and the sounds they make. The letters of the alphabet are, in a sense, completely arbitrary. There is no good reason why the squiggle "a" should form the vowel sound that we all associate it with. Yet we accept that pupils have to learn the relationship between these arbitrary squiggles and sounds as a precursor to being able to make meaning from them. Learning such facts does not preclude meaning: it allows meaning. As the pupils commit these facts to memory, they are expanding their long-term memories, improving their ability to communicate, and developing a more sophisticated mental apparatus.

By neglecting to focus on knowledge accumulation, therefore, and assuming that you can just focus on developing conceptual understanding, today's common yet misguided educational practice ensures not only that pupils' knowledge will remain limited, but also that their conceptual understanding, notwithstanding all the apparent focus on it, will not develop either. By assuming that pupils can develop chronological awareness, write creatively, or think like a scientist without learning any facts, we are guaranteeing that they will not develop any of those skills. As Willingham and others have pointed out, knowledge builds to allow sophisticated higher-order responses. When the knowledge base is not in place, pupils struggle to develop understanding of a topic.

Throughout this article, I have tried to stress that I share the aims of many of the people whose methods I disagree with. I agree that education should aim to produce confident, creative, and problem-solving critical thinkers. I agree that we should prepare pupils for the 21st century. I agree that we should design our education system to suit everyone, not just the high achievers. I agree that education should be concerned with democracy and equality. I agree that pupils should be active learners and that lessons should be engaging. It is because I believe all of these things that I am so concerned about the current education system. The methods we are currently using to achieve these aims simply do not work.

The main reason they do not work is because of a misguided, outdated, and pseudoscientific stigma against the teaching of knowledge. The evidence for the importance of knowledge is clear. We have a strong theoretical model that explains why knowledge is at the heart of cognition. We have strong empirical evidence about the success of curricula that teach knowledge. And we have strong empirical evidence about the success of pedagogy that promotes the effective transmission of knowledge. If we fail to teach knowledge, pupils fail to learn.

But very little of this evidence is known or taught within our education systems in the United Kingdom and the United States. The fundamental ideas of both systems are flawed. When one looks at the scientific evidence about how the brain learns and at the design of our education systems, one is forced to conclude that the systems actively impede education. If our curriculum were to promote learning, then it would specify a core, coherent, and sequenced body of knowledge. Instead, it specifies no knowledge and suggests that the knowledge that is taught is unimportant in comparison to skills. If our pedagogy were to promote learning, then it would recognize the importance of teacher-led instruction and guided practice. Instead, teachers are advised not to direct their pupils and are encouraged to facilitate unguided projects. If our schools wanted to ensure that all pupils could read effectively by the time they were 16, then they would focus on gradually building up the amount of important cultural knowledge pupils needed to learn. Instead, schools teach random and often trivial bits of information, many of which the pupils already know.

In my time as a teacher, I followed education policy closely, but I never encountered any of the evidence about knowledge I speak of here until I researched the issue, nor did I actually hear anyone advocate the importance of knowledge. I struggled to improve my pupils' education without ever knowing that I could be using hugely more effective methods. I would spend entire lessons quietly observing my pupils chatting away in groups about complete misconceptions, and I would think that the problem in the lesson was that I had been too prescriptive. We need to reform teacher training programs in both the United Kingdom and the United States so that they stop promoting completely discredited ideas and give more space to theories with much greater scientific backing.

However, at its heart, this is a problem of ideas, not institutions. While some institutional and structural reform may be valuable, what needs to change most of all is our reliance on defunct ideas. At stake is the education of all our pupils, and particularly the education of our least advantaged pupils. Unless we place the powerful and liberating force of knowledge at the heart of our education system, it will continue to fail our pupils and to deepen inequality. ☐

Endnotes

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14. Originally broadcast on June 21, 2012. Barely a month can go by without an article in the educational press mentioning Thomas Gradgrind. Here are a few selections from 2012: Richard Garner, "Back to Basics: Will Gove's National Curriculum Overhaul Prepare Children for the Future?," *Independent*, June 14, 2012; Laurie Penny, "To Hell with the Gradgrinds—Go to University," *Independent*, August 16, 2012; Terry Deary, "History Is about People, Not 1066 and All That," *Telegraph*, September 27, 2012; and Simon Jenkins, "Michael Gove's Centralism Is Not So Much Socialist as Soviet," *Guardian*, October 11, 2012.

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