theguardian

# Can neuroscience solve the mystery of how students learn?

Educational neuroscience burst onto the scene with the hope of explaining how we learn. But the jury is still out on whether it's useful for classroom practice

**Ben Martynoga**

Sunday 12 July 2015 03.00 EDT

No one knows how much knowledge students take home with them after a day at school. Tests, homework and inspections give a snapshot of learning but ultimately it's something that you cannot see; it's invisible and personal.

The educational researcher Graham Nuthall spent 40 years trying to understand how we learn. He wired classrooms in New Zealand for sound, installed video cameras, sat in on lessons and interviewed hundreds of students. But despite crunching mountains of data, he was not able to draw any conclusions.

In recent years, a new field of enquiry has burst onto the scene with the hope of finally unlocking the secret of how learning takes place. It's been referred to as educational neuroscience, neuroeducation and mind, brain and education.

This approach has been explored by scientists at Carnegie Mellon University in Pittsburgh, US, who conducted a study last year. They taught students about the inner workings of household objects in a physics lesson which took place inside an fMRI (functional magnetic resonance imaging) brain scanner.

As the students learned about the simple mechanisms, the neuroscientists recorded the activity in their brains. By looking at what patterns appeared, the scientists could work out which mechanism the brain was thinking about. The scientists behind the study made big claims, suggesting this kind of research could lead to improved teaching methods and a new way to assess students' learning.

But not everyone is convinced. Dorothy Bishop, a professor of developmental neuropsychology at Oxford University, has well-reasoned reservations about educational neuroscience.

For her, the brain images fMRI studies generate are inherently vague and the technique is too unwieldy and expensive for routine use in education. Bishop thinks psychologists, who use human behaviour to infer how mental processes work, have much more to offer.

Despite conflicting opinions, the UK's biggest biomedical charity, The Wellcome Trust, last year teamed up with the Education Endowment Foundation (EEF) to back six research projects to the tune of £6.5m that relate neuroscience to the classroom.

Among them is Spaced Learning. Spaced learning is a teaching approach where content is intensively taught multiple times with breaks in between. It was first described by the 19th century psychologist Hermann Ebbinghaus: he found that repetition is crucial for learning, but memories form more readily and durably if these repetitions are spaced out rather than massed together.

Neuroscientists, while investigating memory, stumbled across the spaced learning effect by examining simple reflexes in sea slugs, crayfish and cats - and by probing and stimulating the neurons in thin slices of rat brain. The neuroscientists discovered that repeated stimuli, with precisely timed gaps, are one of the most reliable ways to convince neurons that an event is memory-worthy.

The Wellcome Trust and EEF-funded project, led by the Hallam Teaching School Alliance, plans to see if the insights gained from stimulating neurons in the laboratory environment can be applied to real-world learning.

Dr Paul Howard-Jones, another recipient of Wellcome Trust funding, takes on the challenge of keeping pupils motivated to learn. He bases his idea on humanity's fondness for games, chance and reward.

Neuroscientists have shown that dopamine levels in the midbrain region increase as we anticipate a reward. They rise even more if an element of blind chance determines whether we actually get the reward. Dopamine uptake in this specific context can lead to heightened emotional responses and increased engagement. Moreover, tickling the brain's reward circuitry in this way can enhance the formation of new memories.

Despite all this, the jury is out on the effectiveness of many neuroscience-based interventions in education. An EEF-commissioned review (pdf) published last year focused on 18 areas where neuroscience might have an impact on educational practice; and concluded that, so far, little neuroscience has directly affected teaching in UK classrooms.

If the neuroscience is robust and the idea translatable, however, it makes sense to try out new evidence-based approaches in schools. Teensleep, a project led by Professor Russell Foster, is testing the idea that delaying school start times for adolescents will improve academic achievement. We may not need neuroscience to tell us that teenagers are unresponsive in the morning. But neuroscience can tell us why a good night's sleep is so crucial for memory consolidation, information processing and creativity. It can also show that most teenagers have a delayed sleep-wake cycle compared with adults. Robust neuroscientific evidence could give educators the authority to see if changing the status quo can help.

No one should be looking to neuroscience to provide quick fixes or shortcuts to effective learning, however. Caroline Creaby, assistant headteacher at Sandringham school, says:

“You want things to be hard for kids. You want them to think carefully and to think hard.” Most neuroscientists will endorse this idea: learning results in physical changes to the brain, but dramatic change requires meaningful tasks and considerable effort.

By 2018 the results of Teensleep and the other Wellcome and EEF-funded trials will be in and we’ll finally find out whether these ideas can deliver useful innovations to the classroom. Neuroscientists may make the process of learning a little less mysterious, but they are still long way from being able to see it happen. So even if performance is shown to have improved, we’ll still be wondering what students have actually learned.

*Ben Martynoga is a neuroscientist and science writer. This article was originally published in full as part of the “Brain” season on The Long + Short, Nesta’s free online magazine of ideas and innovation. Read it here.*

**Follow us on Twitter via @GuardianTeach. Join the Guardian Teacher Network for lesson resources, comment and job opportunities, direct to your inbox.**

Continue reading...

More blogposts

## Topics

Teaching tips

Schools

Primary schools

Secondary schools

Neuroscience

More...