Is Educational Neuroscience for Real?

An interview with Dr Martha Burns, neuroscience educator

This interview was recorded on The Learning Capacity Podcast

Interviewer: I'd like to talk with you about educational neuroscience. And this is a concept we're hearing more about in educational discussion, it seems all the time, particularly at things like school conferences. Is this a specialist area of knowledge? Or is it just a general title for intellectual sounding conversation?

Educational neuroscience is a new scientific discipline

Dr. Burns: Actually, it is a new branch of neuroscience. Neuroscience, I should say, is a relatively new discipline. Neuroscience, as a discipline, emerged around 1995. Before that, we had groups of people who studied the brain.

We had neurologists who studied illnesses of the brain. We had neuropsychologists who studied the mind and emotions.

But by around the middle of the 1990s, we had this emerging umbrella field called neuroscience that was actually looking at how the brain works and looking at how the normal brain or typical brain works. And a branch of that that has emerged in the last three or four years is educational neuroscience.

So for a while there was something called cognitive neuroscience. There was something called systems neuroscience. And they were all looking at the brain from different perspectives.

But this new educational neuroscience discipline that's emerged is now a graduate program in many universities here in the United States. If you go online and look at educational neuroscience programs, you'll see that almost all of them started after about 2011 or 2012. Universities would say, "We have just initiated a new doctoral program in educational neuroscience."

So it is a formal discipline. It does exist. It does have its own body of research. But it is brand new.

Interviewer: Okay, so emerging, new and seemingly very current or very much on the minds of course developers in terms of degrees that you can study. People might be thinking, "So, okay, what's it all about? What do you do?"

The best ways to teach different subjects

Dr. Burns: What educational neuroscience is trying to do is figure out, by using very objective measures, what are the best ways to teach different kinds of curriculum. In a recent review I did of the latest educational neuroscience, there was some research on the best way to teach physics.

Or I shouldn't even say the best way yet because I'd say they aren't at the point of quantifying it. But what happens if I teach physics one way versus another way?

What happens if I teach literature? There are three ways of teaching literature:

- Have a student read a book and just reread it over and over again.
- Ask the student to read the book and paraphrase what they read.
- Ask the student to read what they read, then paraphrase it, and then explain it to someone else. They call that self-explanation.

What are the different parts of the brain that are involved when you do that?

Which of those three methods end up having the most lasting results and having the most profound results on the brain?

There's specific research going into the differences between those methods right now.

Pedagogy, philosophy and science

We used to look at education, with what we call pedagogy, which was philosophy. What's your philosophy of teaching? What do you think is the best way to teach science? What is the best way to teach maths? Now, we can actually measure it.

Interviewer: Okay, that's really interesting because we're going from, if I understand this correctly, a philosophical model to more of a mechanical model. Could I use that word?

Dr. Burns: Or scientific model.

Interviewer: Hence, the word educational neuroscience. What extent then does educational neuroscience contribute or relate to data-driven teaching models, for example, standardised testing?

In other words, can we expect high levels of measured student progress by just teaching harder? Or do we really have to look at what's going on in the brain? Or do we just not know that yet?

Good teaching is not necessarily a hard job

Dr. Burns: I would say that neuroscience is pointing to the fact that teaching harder doesn't necessarily mean that you're teaching better, that good teaching is not necessarily a hard job, that there is a science to being a good teacher, as opposed to an art to being a good teacher.

A lot of us used to think, “I know who a good teacher is”, and teaching is an art. If you're a good teacher, it's like being a musician. You have an artistic ability.

But now, what we can say is, no, teaching is not just an art. I can teach you methods that I can show you will:

- Improve your students' retention of the material.
- Improve your students' ability to pay attention to you in class.
- Keep your students motivated.

We are starting to be able to determine what methods and what ways of teaching are more effective.

Data from tests and from brain function

Now, that doesn't mean that the data that we're accumulating comes from tests.

The data that we're accumulating as educational neuroscientists comes from looking how the brain is functioning. So your measurement is brain function.

Teachers build brains. That's what they do. They build, and, in some respects, they change the human brain dramatically, especially if they're very effective.

So what neuroscience allows us to do is see what is an effective teacher, what is it that they do and how does that change the brain. That's pretty exciting when you think about it.

Teachers don’t need to be neuroscientists

Interviewer: From the teacher's perspective what is this actually asking them to do or to be? I can just imagine that teachers might say something like "Wait a second, now you want me to be a brain scientist as well as teach these kids maths"?

Dr. Burns: That's a really good question, because most classroom teachers have not ever had a course in neurology, much less neuroscience. They've been taught methods. They've been taught methodology. They've been taught history, how we teach. And they've also been taught how tests, how data can help us to know how effective we are as a teacher.

And so I don't particularly want teachers to have to worry about what's going on inside the brain of a child who's responding to them. They don't need to know that.

They just need to see that the student is:

- Responding to them better
- Remembering more than they used to remember
- Paying more attention
- More motivated to learn.

Using tests to measure this is a little bit artificial. But we can actually see all of that going on in the brain as neuroscientists. We don't need the teacher to see it. They'll see the behaviour. And they will hopefully be very encouraged by the behaviour they see.

Variations in students' brains and capacity to learn

Interviewer: Does the neuroscientist see a fairly consistent level of children's brain capacity or capacity to learn? Or is there variation?

Dr. Burns: There's quite a bit of variation. The human brain is quite variable from person to person. And it varies in all of us over time. So our brains are changing and maturing throughout our life. Our brains are very plastic.

Part of what neuroscientists are asking is, what is the best way to use the brain? What is it that we want to see? What is a learning brain versus a non-learning brain? Can we see differences? And what can we do to take a child who seems to be successful, let's say, in reading and a child who isn't successful in reading?

Can we look at their brain, see how they're different, and then figure out what are the best teaching methods to get the child who's having trouble to look like the child who's not having trouble?

Interviewer: Is it possible to think about this in terms of building a brain's capacity to learn anything?

Dr. Burns: Yes, that's a good way to think of it.

Interviewer: So are there things that educators could do, and I'm thinking now particularly of primary educators, that would allow them to prepare a young person's brain so that they had the capacity or the ability to adapt to whatever interested them?

Dr. Burns: Yes. If you think about capacities, if we think about anything else that we're training someone to do. Let's say I'm training someone to play football or soccer. And I know that that person has to have certain capacities to be able to do that.

I know that person has to be able to run quickly. I know they have to have hand-eye coordination. I know they have to have some strength. Those are some capacities they have to have.

And then if they have those capacities, I can teach them the game. I can teach them the rules. I can teach them the strategies. I can teach them the teamwork.

Missing in education – an understanding of the student's capacities

I think what's been missing is education is that we haven't known what those capabilities were. We didn't know what makes someone good at reading or what underlying capacities are needed to make someone good at maths.

And can we identify those students that don't have those capacities? And then are there neuroscience interventions that can build up those capacities?

Interviewer: Is the neuroscience telling us that there's one capacity at the moment that seems to be the one that underpins them all?

Dr. Burns: No, not one only. There are some that are very important. One is attention, and another one is working memory. For learning, you have to be able to sit in a classroom and attend on command, and you have to be able to hold information in your mind.

And those seem to be two core capacities for learning. But there are others.

What educational neuroscientists are learning is that there are a few core capacities that underlie all learning:

- Being able to pay attention on command
- Being able to have good working memory skills
- Being able to hold on to what you've heard or what you've read for an hour or two hours or four hours.

Those are very important core capacities.

But there are other capacities. For example, to do maths, you need the capacity of number sense. You need to be able to have a sense of more and less and far and near and high and low and big and small. To be good at reading, you need language skills.

So neuroscience is working very hard to determine what those underlying capacities are. And then also determine, if the student has a weakness in one of those capacities, what do you do about it? How can you build that capacity?

Tips for teachers

Interviewer: Now, I'm imagining that some teachers listening in to this conversation might be thinking, "Wow, this sounds really exciting. I'm motivated by this. I would really like to be more involved in this."

Let's say they wanted to experiment with some teaching techniques which were directly informed by educational neuroscience, how would they start?

Dr. Burns: Well, there are some books out that are excellent. There's a book by Eric Jensen called "Teaching with the Brain in Mind" that, first of all, explains educational neuroscience to teachers but also gives very helpful suggestions to them of ways that they could start incorporating neuroscience approaches in the classroom.

I would also say webinars and podcasts like this are helpful. I'm sure there are more and more of these out there. There's a conference called the Learning in the Brain Conference in the United States, which is just about this very topic of educational neuroscience and what we've learned in the last year and what are some of the new approaches that teachers could try.

Going online and actually doing a Google search or a search for educational neuroscience, professional development or opportunities for webinars, online courses that teachers could take, I think they would enjoy all of those.

Interviewer: I'm glad to hear that there's all this material coming out. Because I was thinking, when I was at a conference earlier this year, that educational neuroscience was just being used as another one of those popular terms. Part of the purpose of this podcast is to raise awareness of the fact that it is actually a real thing, and you can learn about it.

Dr. Burns: Exactly. I've heard the same thing from teachers, "So this is just the next new thing. And in three years from now, it'll be something else."

And what I like to say to them is that we now know enough about the human brain and we understand it well enough to be able to use that information to enable all teachers to be better at what they do.

And honestly, I've never met a teacher who didn't want to be good at what they did. They love teaching. They want to be effective teachers. And neuroscience offers them a way to learn more about what being an effective teacher is.