

Learnus<sup>TM</sup>

# UNDERSTANDING LEARNING: engaging brains and building networks

A Learnus pamphlet

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Learnus: the think tank for Learning Skills Research (LSR)

## About the author

**Derek Bell** is a teacher, researcher, advisor and advocate for improving and enriching education for all. He worked in schools and universities before becoming Chief Executive of the Association for Science Education (ASE) and Head of Education at the Wellcome Trust. He remains very active in education, nationally and internationally, through his consultancy (Campanula Consulting), committee and advisory work and has a wide range of publications. He is currently a trustee of the IBM Trust UK, Understanding Animal Research and Centre of the Cell in the UK, a member of the Inter Academies Panel Global Education Committee and on the judging panel for the European Union Competition for Young Scientists. Derek is Director of Learnus™, professor of education in the College of Teachers and a visiting research associate at the Institute of Education, University of London.

# Foreword

The record of schools learning from the latest developments in other fields hasn't always been as strong as it should have been and the latest technological or scientific developments haven't always been reflected in classroom practice. The idea of education – both policy and practice – being an evidence based profession has been slow to gain support.

This does seem to be changing however, as researchers, teachers and policy makers tentatively begin to work together to share knowledge and skills in the interests of improving practice in the classroom. These new partnerships could make a real contribution to the next phase of school improvement and our understanding of the processes of learning.

The relationship between neuroscientists and teachers could be strengthened as a result of this new approach. Most of what we know about how the brain works has been discovered in the last two decades. It makes sense that this should have an impact on our approach to how children and young people learn. In every field there is a moment when a discovery makes a real difference – the discovery of antibiotics for medicine or the engine for transport. The findings coming from neuroscience could be one of those moments for education.

If we are to see this happen, there must be a structure in place including a group such as Learnus™ so that teachers can readily access the latest information in a way that they can use it effectively in the classroom. This booklet begins to explore some of these issues and in that way makes a valuable contribution to the emerging debate. This could be an exciting time for those working both in neuroscience and education if they can bring together their areas of expertise around a shared objective of further improving the standards of teaching and improving chances for children.'

**Baroness Morris of Yardley,**  
former Secretary of State for Education,  
Chair of IEE (Institute for Effective Education)

# Message from Chair Learning Skills Research

Learning Skills Research is an independent charitable organisation devoted to improving the quality of learning. We do this by identifying, supporting and promoting effective learning skills based on sound academic research.

In 2012 we established Learnus as a think tank with a focus on understanding learning with a mission to act as a bridge between high quality up to date academic research and the classroom and to share our findings with education policy makers and practitioners working in schools, colleges and other education services. To this end, as well as supporting the work of Learnus, LSR seeks to raise funding in order to initiate and sustain a variety of activities in this field.

It is a well-established fact that different minds think and work in different ways and yet, all too often, this is either not recognised or cannot be accommodated in the classroom. The result is that many of us underperform both at school and later on, in the workplace. At Learning Skills Research we have a simple dictum..... **“How to learn”** is every bit as important as **“What to learn”**. We believe that given an appropriate choice of learning techniques, every child could and should enjoy greater success in the learning environment and go on to lead a fuller life and make a more valuable contribution to our society.

All too often those of us who are exploring in our different ways the connections between our thinking, the brain and learning processes with the aim of discovering and promoting new learning techniques have failed to communicate effectively enough with each other, teachers parents and the wider community. It was to try to address this gap that Learning Skills Research set up Learnus and why I am very pleased to welcome this, the first of its pamphlets.

## **Chris Green**

Chairman, Learning Skills Research Limited

# What is Learnus?

**Learnus is a community dedicated to bringing educators and those who specialise in the study of the brain, the mind and behaviour together in order to use the insights gained from high quality research to improve and enrich learning for all.**

We believe that a better understanding of the developing mind, involving neuroscience, psychology and social anthropology, can help inform curriculum and pedagogical development that is more attuned to the actual needs of learners. We believe that this can have a profound impact on improving the education of all, young and old alike.

Our mission is to act as a bridge between academic research, study of the brain and learning, and classroom practice. We want to share our findings with education policy makers and practitioners working in schools, colleges and other education services in order to bring into mainstream and special learning the growing body of evidence from the neurosciences and education about **how we learn**.

## **Learnus is facilitating dialogue between different professional communities**

Learnus has established a programme of lectures and mediated workshops on a wide range of topics (see Table 1). The key feature of these events is that the participants include: teachers, neuroscientists, cognitive scientists, psychologists, researchers and practitioners from across all these fields.

**“The mediated workshops have given me a wonderful opportunity to increase my understanding of developments in neuroscience and the ways in which they can positively influence learning and teaching. It is useful to have the time to discuss the possible application of current research in the educational setting and, in doing so**

**I have been able to share this more widely with other teachers and professionals.”**  
(Jo Cole, Learning & Teaching Coordinator, Greenford High School, Ealing)

**“Relating the research to the speaker’s personal areas of interest and ‘story’ brings it alive.”** (Margaret Mulholland Director of Development & Research, Swiss Cottage School)

## **Learnus is developing partnerships with leading organisations**

Learnus is building partnerships across the communities including a strong relationship with the Centre for Educational Neuroscience<sup>1</sup>, London.

**“In the last two decades, neuroscience has made great strides in understanding the multiple mechanisms that the brain uses to learn. It is now time for neuroscience to contribute to education, to embrace the enthusiasm of teachers for brain-based approaches, and to offer them new, scientifically grounded tools for enhancing educational outcomes across the lifespan”** – (Professor Michael S. C. Thomas, Director of the University of London Centre for Educational Neuroscience).

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<sup>1</sup>The Centre for Educational Neuroscience, is a partnership between University College London, Birkbeck College London, and the Institute of Education, London. Further details: [www.educationalneuroscience.org.uk](http://www.educationalneuroscience.org.uk)

## Learnus is taking the messages into schools

Learnus runs professional development sessions introducing teachers and students to ways in which understanding the brain may contribute to improvements in teaching and learning.

“Working with Learnus has been an inspirational experience, the workshops have provided an illuminating insight into the academic world of educational neuroscience - all staff that have been involved in these come away with many new ideas and encourage others to take part ..... Sessions are always well received and are now embedded into a valued part of our staff training.”

(Peter Mather, Head of Training and staff development, Greenford High School, Ealing)

“My interest in Learnus ignited when I became aware of their desire to develop stronger links between education and neuroscience. I believe that by learning more about how the brain operates increases the potential for educators, and students, to accelerate learning.” (Peter Burton, Assistant Head of Grinling Gibbons Primary School)

**Table 1: Examples of Learnus events**

Lectures	Mediated Workshops
Applying neuroscience to the mainstream curriculum: Are we wired for Science?	How could neuroscience influence education? (and vice versa!).
The Adolescent Brain	The science and art of reasoning.
When to Learn what? The Brain's readiness to learn at different ages.	Three further mediated workshops are planned for 2014 in Crediton, Cambridge and Birmingham
Building Plastic Brains: are there sensitive periods after which children's learning abilities decline?	
Kids Behaving Badly: How neuroscience can help?	

To join the Learnus community go to <http://learnus.co.uk/membership.php>, email [communications@learnus.co.uk](mailto:communications@learnus.co.uk), visit [www.learnus.co.uk](http://www.learnus.co.uk)

**Learnus is a not-for-profit organisation, independent of commercial and political influence**

# UNDERSTANDING LEARNING: engaging brains and building networks

## Why bother?

Education, it can be argued, is what distinguishes humans from all other animals. It provides the underpinning of our cultures and our ability to overcome the challenges we face both as individuals and as a global society. The knowledge and understanding of the world around us that has been developed is the result of humans having the capacity to learn. We know that learning takes place through our interactions with our environment from the moment we are born until we die. We also know that learning can be enhanced through teaching and planned interventions but we don't know why some approaches are more effective than others or why some people appear to be more receptive to learning from their experiences and activities than others.

Ultimately learning depends on what goes on in the brain and the processes by which we 'make sense' of what we see, hear, feel, smell, taste and do. Our understanding of how the brain works is growing rapidly as new techniques and technologies provide further insights into the structure and function of the brain. However, the way in which activity in the brain relates to our mental processes of thought and reasoning, for example, is still far from clear. In short our knowledge of the brain in relation to our understanding of learning is very much in its infancy.

Working to understand how we learn is an imperative, not only from the perspective of a scientific endeavour – to know for its own sake – but also because there is a moral purpose – to improve the life chances of individuals and the well-being of society.

## Why now?

Advances in scientific techniques and technology now make it possible to gain greater insights into the structure and function of the brain. There is an increasing ability to test theories of learning in relation to brain activity. There is also widespread interest in the field of educational neuroscience and a momentum, nationally and internationally, for developing this further. For example, in the UK this interest has been demonstrated by the recent call for proposals<sup>2</sup> to develop, evaluate and communicate the impact of educational interventions grounded in neuroscience research. The idea that a greater understanding of how the brain works can improve teaching and learning is very seductive. As summarised in a report from the Royal Society in 2011, "Education is about enhancing learning and neuroscience is about understanding the mental processes involved in learning. The common ground suggests a future in which educational practice can be transformed by science just as medical practice was transformed by science about a century ago."<sup>3</sup>

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<sup>2</sup>Education Endowment Foundation / Wellcome Trust call for proposals, Using insight from neuroscience to improve education. Available at: <http://educationendowmentfoundation.org.uk/apply-for-funding/neuroscience-round/> (last accessed 27 March 2014)

<sup>3</sup>Royal Society (2011) Brainwaves Module 2: Neuroscience: implications for education and lifelong learning. Available at: <http://royalsociety.org/policy/projects/brain-waves/education-lifelong-learning/> last accessed 27 March 2014)

The link is far from straightforward and there is no 'silver bullet' on the horizon. Recent history tells us that attempts to make simplistic links have resulted in a series of what are often referred to as 'neuromyths'. At best these are misleading but, more fundamentally, they undermine trust in claims that are genuinely underpinned by sound evidence.

Thus there is an urgent need not only for more research which crosses the boundaries of the different disciplines (neuroscience, cognitive sciences, psychology and education) involved but also for reliable up to date sources to which individuals and communities can refer. If we do not build on the work that has already been done and build the bridges between the disciplines then it will be even longer before we find out what the benefits might be.

**"Links between neuroscientists and teachers are in danger of being broken by inadequate information. It is important therefore to have honest discussions about our common aim to improve education and to develop a plan for action."**(Professor Dame Uta Frith, University College London)

## What do we know?

In its report, *Understanding the Brain: the birth of a learning science*<sup>4</sup>, the OECD argued that educational neuroscience builds on knowledge of existing practice and observation but emphasised that "its important contribution is in enabling the move from correlation to causation." In other words it can shed light not just on whether two things happen together but on whether one causes the other. The project identified several areas where educational neuroscience is providing evidence that can inform educational practice and policy making including:

- the capacity for learning is a lifelong activity;
- the identification of learning interventions that can help address problems of cognitive decline during aging especially with aspects of dementia;
- the need for holistic approaches to learning that recognise the

interdependence and interplay between the body and mind, the emotional and cognitive, the analytical and creative;

- insights on adolescence, balancing the high cognitive capacity of young people with their relative emotional immaturity;
- a better understanding of conditions for improving how and when learning might be most effective;
- the contribution to particular learning challenges including dyslexia, dyscalculia and dementia as well as other specific conditions;
- ways to improve the personalisation of learning.

More recently the Brain Waves project added to this list when it identified some key insights from neuroscience that could eventually contribute to important improvements in educational practice. Greater understanding of the role of biological factors in learning are beginning to throw more light on differences in learning abilities, more detailed understanding of specific conditions and why certain types of learning seem to be more rewarding than others. The brain enables learning but learning also changes the connections made in the brain. However, if that learning ceases to be used connections can weaken, so 'use it or lose it' is an important principle for life-long learning. This reinforces the findings that continued learning can have significant positive effects well into old age. Brain Waves<sup>5</sup> also identified how insights from neuroscience can inform and influence the development and use of adaptive digital technologies, inside and outside the classroom, and throughout life.

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<sup>4</sup> OECD (2007) *Understanding the Brain: the birth of a learning science*. Centre for Educational Research and Innovation (CERI), Organisation for Economic Co-operation and Development (OECD) Publishing, Paris.

<sup>5</sup> Royal Society (2011) *Brainwaves* Module 2: Neuroscience: implications for education and lifelong learning. Available at: <http://royalsociety.org/policy/projects/brain-waves/education-lifelong-learning/> last accessed 27 March 2014)



The possible contribution of neuroscience to education was taken a step further by Paul Howard-Jones<sup>6</sup> in his review to consider “the extent to which insights from the sciences of mind and brain influence, or are close to influencing, classroom practice”. This is not the place to go into the details but the findings show that there are interventions, supported by varying amounts of evidence, which could be implemented almost immediately. There is, however, the underlying caveat, expressed in all three reports, that there is still a long way to go and caution is required before rushing into adopting ‘brain-based’ methods.

“...teachers’ desire to implement interventions based upon neuroscience is evident, but it is running ahead of the evidence base. There is thus an urgent need to improve this evidence base and to support teachers in developing both their understanding of neuroscience and their ability to judge the evidence for these and other educational interventions.” (Wellcome Trust Teacher and Parent Survey 2014<sup>7</sup>)

## What are the challenges?

Despite the current appetite for building links between education and neuroscience, there are those who argue that there is not enough evidence, that it is too early to be talking in this way, and that it is not possible to make direct links<sup>8</sup>. Unquestionably there are challenges which must be overcome but we have to start somewhere.

In any field of human endeavour there are issues of resources to be tackled and there is the need to ensure that the right expertise is available to carry out the necessary activities. Educational neuroscience is no different but it is also imperative that we recognise the complexity of the issues it is trying to address. This calls for inputs from a range of disciplines but interdisciplinary / multidisciplinary areas of study are notoriously difficult to establish and gain recognition. However, in order to understand learning better it is a challenge that must be overcome and the communication between the different communities improved significantly.

A particular challenge for educational neuroscience is the need to avoid getting carried away with unrealistic expectations. There have been too many examples of the false claims for ‘brain-based’ schemes unsupported by evidence, the mis-use of evidence and the lack of rigour in evaluating the effects of interventions. Ways to combat such developments must be found in order to prevent the authentic research and its potential impact being undermined. Establishing and, importantly, maintaining its credibility will be an ongoing challenge for educational neuroscience.

“In recent years, educational psychologists and cognitive neuroscientists have recognised that it is possible to build more integrated models of learning which do better justice to its complex nature. If we want to achieve any full account of learning, it has become plain that this will depend on bringing together social, cognitive and neural processes within a single framework that seeks to understand how these interact with and impact on each other. It is only by doing this that we will be properly able to understand what happens in both formal and informal educational settings, and plan for a future in which learning can be genuinely optimized for all.” (Professor Andy Tolmie, Professor of Psychology and Human Development, Dean of the Doctoral School, Institute of Education, London)

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<sup>6</sup> Howard-Jones, P. (2014) A Review of Educational Interventions and Approaches Informed by Neuroscience. The Education Endowment Foundation, London, Available at: [http://educationendowmentfoundation.org.uk/uploads/pdf/NSED\\_LitReview\\_Final.pdf](http://educationendowmentfoundation.org.uk/uploads/pdf/NSED_LitReview_Final.pdf)

<sup>7</sup> Simmonds, A. (2014) How neuroscience is affecting education: Report of teacher and parent surveys. The Wellcome Trust, London, Available at: [http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh\\_peda/documents/web\\_document/WTP055240.pdf](http://www.wellcome.ac.uk/stellent/groups/corporatesite/@msh_peda/documents/web_document/WTP055240.pdf)

<sup>8</sup> See for example: Stewart, W. (2014) Neuroscience is a no-brainer? Think again, expert says. TES 28 February 2014

## What next: a road map for educational neuroscience?

The first step must be to continue the discussions that are already taking place and to build on the embryonic networks that currently exist. However too much of the activity is taking place in isolation. If we are to understand learning better we need to bring the various parties together and join up the networks. Not only do we need to address the questions about how the brain works and what this might, or might not mean, for educational practice, but we also need to tackle the challenge of translating the research in order to transform practice and influence policy. This requires a more strategic approach to the problem.

Currently in the UK there several centres developing work in educational neuroscience. There are also funders showing increased interest in the field and there is growing interest from teachers and other educational professionals in the potential benefits that educational neuroscience might bring to the classroom. There are also examples of recommendations on the table for action. The Brain Waves<sup>9</sup> project, for example, argued that:

1. Neuroscience should be used as a tool in educational policy.
2. Training and continued professional development of teachers should include a component of neuroscience relevant to educational issues, in particular, but not restricted to, Special Educational Needs.
3. Neuroscience should inform adaptive learning technology.
4. Knowledge exchange should be increased.

It is difficult to disagree with such statements but behind them lie many questions that need to be addressed and actions to be taken if they are to be turned into reality.

**This paper argues that what educational neuroscience in the UK requires now is a roadmap setting out what needs to be done in order to maximise the potential for, and of, work in this field.** Developing such a roadmap would require a co-ordinating group to review existing recommendations, prioritise actions for implementation and propose mechanisms for monitoring progress and the evaluation of impact. Such a group would need to involve all communities across the diverse disciplines of education and neuroscience, researchers, practitioners and policy-makers.

**A key element of any future development would be the establishment of a UK-wide network for educational neuroscience.** This could be based around multi-disciplinary centres of excellence that would be charged with not only research in the field but also with developing means to translate research findings into educational practice. As a network it would be a strong advocate for the use of evidence in developing policy which in turn supports good practice. In short a roadmap and a UK-wide network would be engaging brains and building networks in order to improve our understanding of learning, thereby improving our educational practices, the life chances of individuals and ultimately the well-being of our society.

**“It’s great to see such an innovative approach to bringing these disciplines together. If we are to make the right changes on a practical level in the classroom, it’s vital that education is informed by good quality research from the cognitive and neuro-sciences as well as education. I hope that policymakers will take note and see how this approach can work more widely.”** (Charlotte Leslie, MP)

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<sup>9</sup> See pages 19-21 in Royal Society (2011) Brainwaves Module 2: Neuroscience: implications for education and lifelong learning. Available at: <http://royalsociety.org/policy/projects/brain-waves/education-lifelong-learning/> last accessed 27 March 2014)

# A role for Learnus

Learnus is unique in this arena. In terms of its mission and commitment, Learnus, with appropriate support is well placed to play a leading role in developing such a roadmap and establishing a UK-wide network for educational neuroscience.

“Within the proverbial ivory tower a remarkable pioneering is taking place into the academic territory of neuroscience. The brilliance of Learnus is that it has engendered excursions from the tower by some of the great academic minds involved to talk with those of us who are engaged more directly with helping our children learn effectively. Thus knowledge informs practice and conversely practice informs knowledge, and we are all on a wagon train rolling together towards distant new frontiers of human potential, individual achievement, and indeed the essential human capital that powers our economy.” (Nigel Armitstead, Educational Psychologist, working for Lewisham)

Learning Skills Research (LSR) is a registered charity whose aims are to identify and share new developments in learning promoting their application by connecting ideas with practice. Since its formation in 2008 LSR has run lectures and published books which focus on learning techniques. It established and funds the Junior Memory Championship, a major educational initiative for primary schools (now in its sixth year) bringing valuable memory techniques to the forefront of learning. LSR has also raised funds for the Aston Phonics Comparison Research Programme, which sets out to test the extent to which children's reading difficulties can be averted. This research programme has now been completed. In 2012 LSR set up and formed its own think tank, Learnus™.

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Learnus™ is the think tank for Learning Skills Research (LSR) dedicated to bringing educators together with those who specialise in the study of the brain, mind and behaviour in order to use the insights gained from scientific study to improve and enrich learning.

#### The Learnus Council Team:

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