

# Neuroscience & Education: Directions that could lead us astray.

**Professor Bridie Raban**

Honorary Professor  
University of Melbourne  
Deakin University, Australia.



# Decade of the Brain 1990s National Science Foundation

[Center of Excellence for Learning in Education, Science, and Technology \(CELEST\)](#)

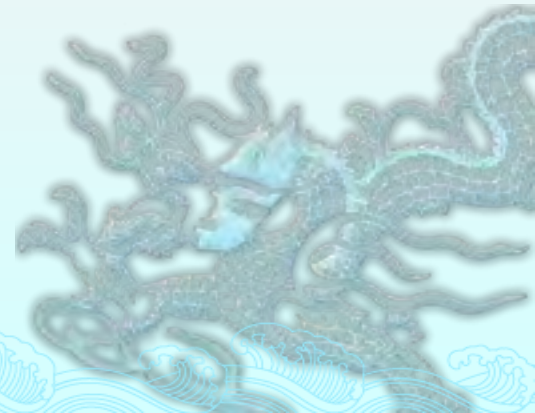
[Center for Learning in Informal and Formal Environments \(LIFE\)](#)

[Pittsburgh Science of Learning Center for Robust Learning \(PSLC\)](#)

[Spatial Intelligence and Learning Center \(SILC\)](#)

[Temporal Dynamics of Learning Center \(TDLC\)](#)

[Visual Language and Visual Learning Center \(VL2\)](#)



# Test Your Brain Knowledge:

Paul Howard-Jones

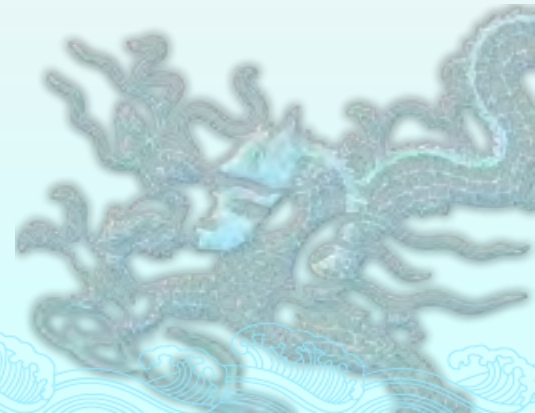
University of Bristol UK

- ♦ <http://www.edweek.org/ew/section/infographics/test-your-brain.html>



## True or False?

Children use different memory systems to ride a bike and recall a phone number.



# True



## True or False?

Drinking less than the equivalent of six glasses of water per day can cause the brain to dehydrate and shrink, impairing learning.

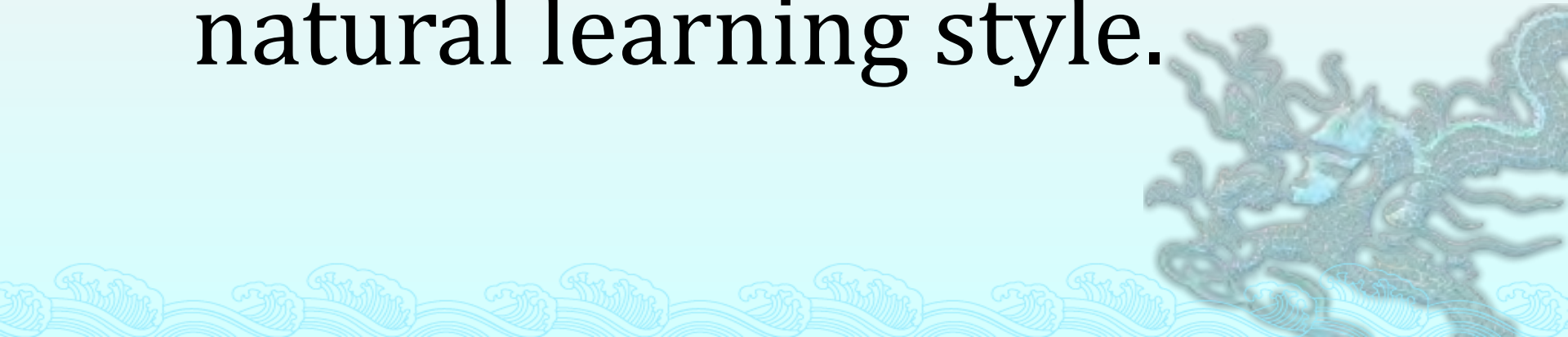


False



## True or False?

Children learn better when the instructional format, such as auditory, visual or kinesthetic, matches their natural learning style.

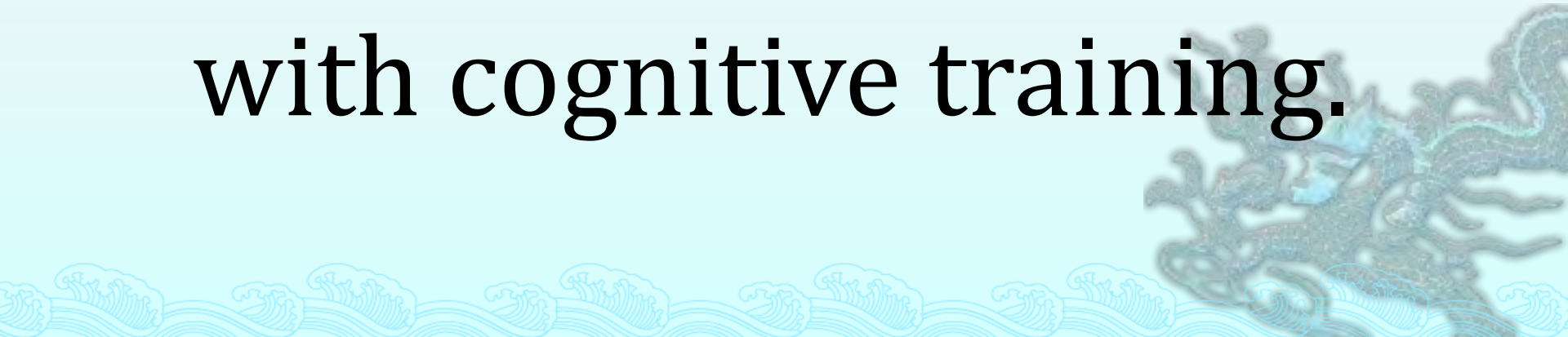


False



## True or False?

Most people do not use their entire brain, but it is possible to bring more of your brain "online" with cognitive training.

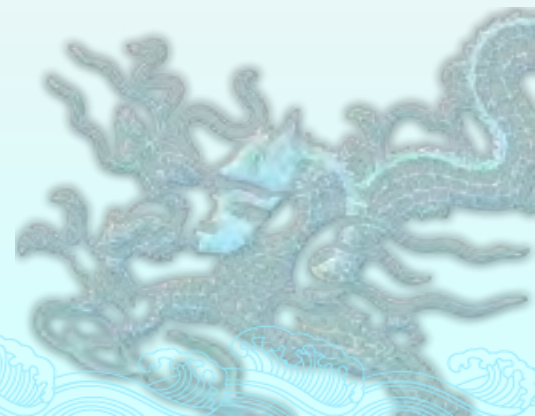


False



## True or False?

Cognitive and physical exercises can help integrate the hemispheres of a child's brain.

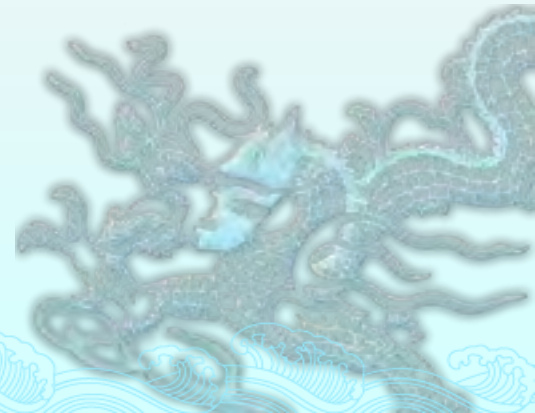


False



True or False?

Emotion impacts  
reasoning and  
memory in the  
brain.

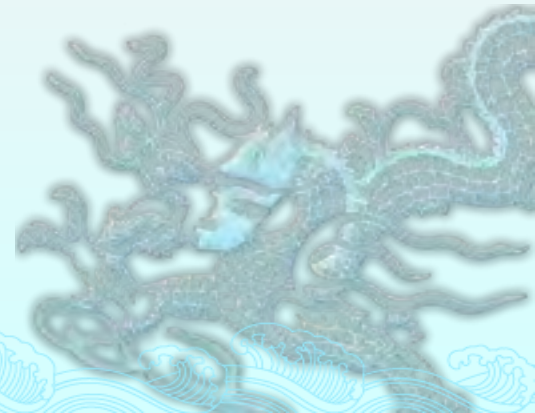


True



## True or False?

If a child does not learn a language before the critical window closes, he or she will never become fluent.

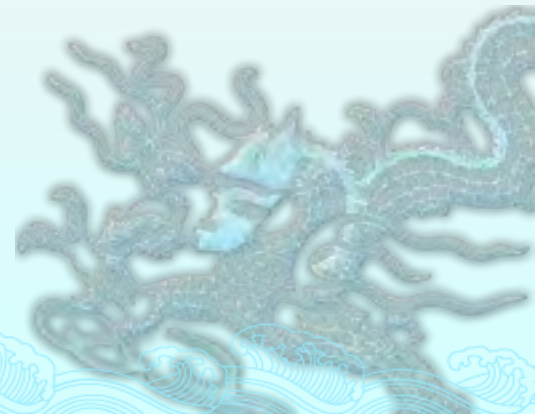


False



## True or False?

Boys' brains are  
hardwired to be better  
at spatial tasks than  
girls' brains.



False



## True or False?

Except in cases of extreme injury or trauma, brain cells no longer make new connections after age 18.

False



## True or False?

A learning disability associated with genetic differences in the brain can be remediated by education interventions.



True





# Neuromyths

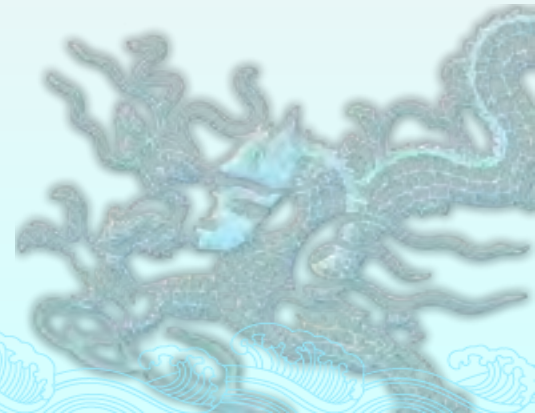
“A misconception generated by a misunderstanding, a misreading or a misquoting of facts scientifically established (by brain research) to make a case for use of brain research in education and other contexts.”  
(OECD 2002/7: 111 *Understanding the Brain*)

- ◆ Resulting in simplistic interpretations of what we know.
- ◆ Fabrications of material to substitute for what we don't yet know.
- ◆ Misunderstanding what all this might mean.



# Important distinctions

- ◆ **Neuroscience:** Biology
- ◆ **Cognitive psychology:**  
Behavioural Science
- ◆ **Education:** Social Science



# Early Childhood Development

- ◆ Critical v. Sensitive periods
- ◆ Bilingualism – concurrent or not
- ◆ 10% brain used
- ◆ Left & right hemispheres
- ◆ Enriched environments
- ◆ First three years

Zigler, E.F., Finn-Stevenson, M. & Hall, N.W. (2002)

*The First Three Years and beyond: Brain development and social policy.*

New Haven: Yale University Press.



Bruer, J.T. (1999) *The Myth of the First Three Years*  
New York: The Free Press.

Koisumi, H. (2012) in Della Sala & Anderson 319-334

1. Rapid synaptic development during the first 3 years
2. Critical v. sensitive periods – expectancy vs dependency
3. “enriched” environments.

Santiago Declaration

<http://www.jsmf.org/santiagodeclaration/>

# Experiences Build Brain Architecture

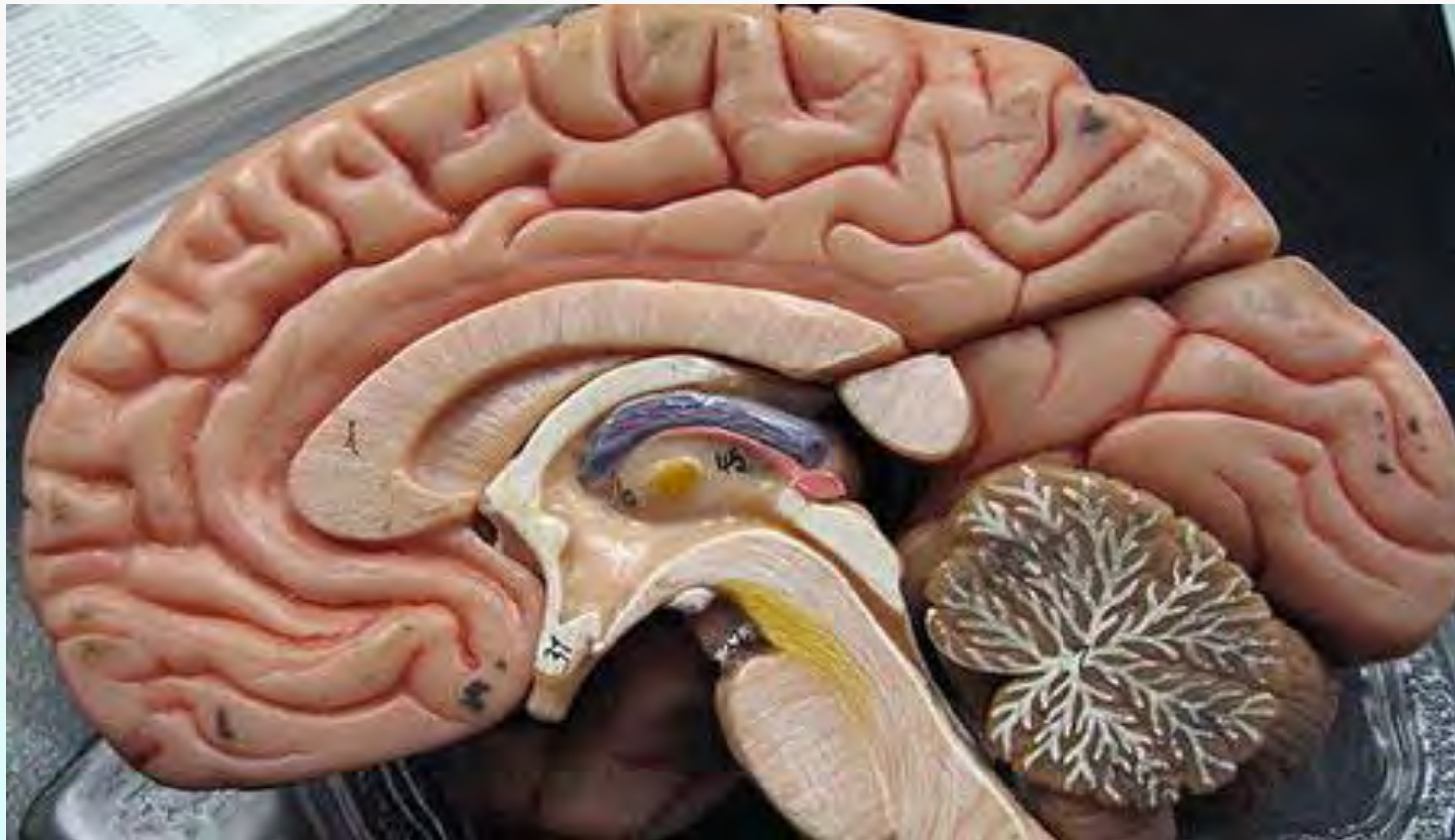
<https://www.youtube.com/watch?v=VNNsN9Ijkws>



# 1. More information doesn't mean more learning



## 2. The brain is a highly dynamic organ



### 3. Emotion influences the ability to learn



## 4. Mistakes are an essential part of learning



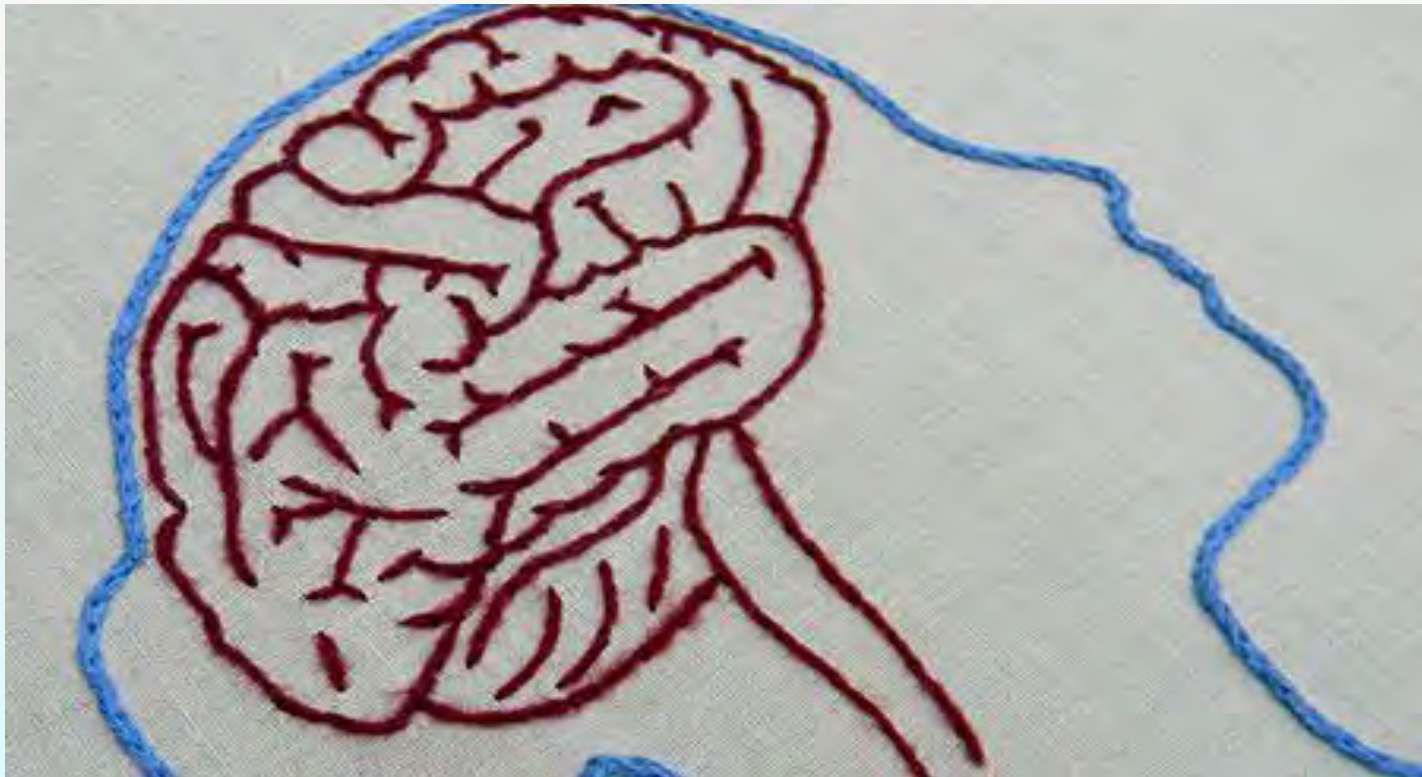
## 5. The brain needs novelty



## 6. There are no learning styles



## 7. Brains operate on the “use it or lose it” principle



## 8. Learning is social



## 9. Learning is best when innate abilities are capitalised on



# 10. Learning changes the brain structure



# Susan Greenfield

“Learning occurs when neurons set up *networks* that fire together, the more you use a skill the more developed those *networks* are, until eventually it becomes automatic.”



# Marie Clay

“The goal of teaching is to assist the child to construct effective *networks* in his brain for linking all the strategic activity that will be needed to work on texts, not merely to accumulate items of knowledge.”

LL/2 p.116



# Different discursive standpoints towards the discipline of Educational Neuroscience

## Cautious Optimism

It is *possible* to bridge 'the gap'  
with Educational Neuroscience.



## Misguided Enthusiasm

Leaps 'the gap' with Brain-Based  
Learning Industry (cf. neuromyths).



Educational  
Neuroscience

## Pessimistic Scepticism

It is *impossible* to cross 'the gap',  
the dissimilarities are too immense.



## Hesitant Optimism

It is *possible* to bridge 'the gap',  
*but* Educational Neuroscience  
will be a bridge too far.

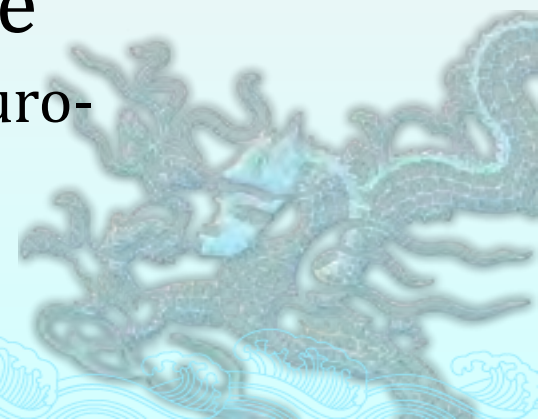
# Obama backs brain-mapping project

Obama offers \$100m to map human brain

Date April 4, 2013

Seeking to 'revolutionise our understanding of the human mind', the White House pushes a new **BRAIN** Initiative – NSF website

Brain Research thro' Advancing Innovative Neuro-technologies



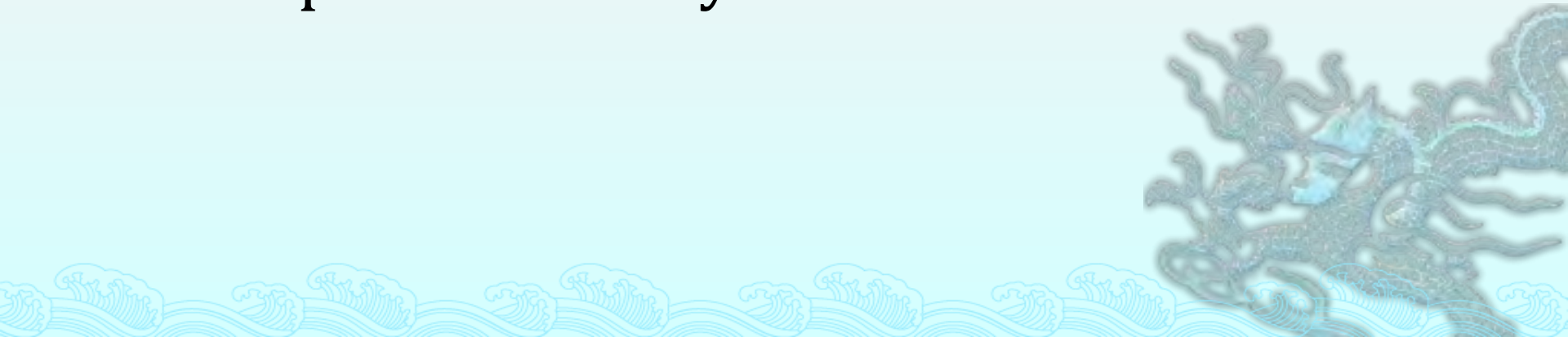
# South China Morning Post

Friday May 3<sup>rd</sup>. 2014

## WORLD NEWS:

Videogames halt age-linked brain decline.

Playing games can even reverse deterioration  
and improve memory > PAGE A14



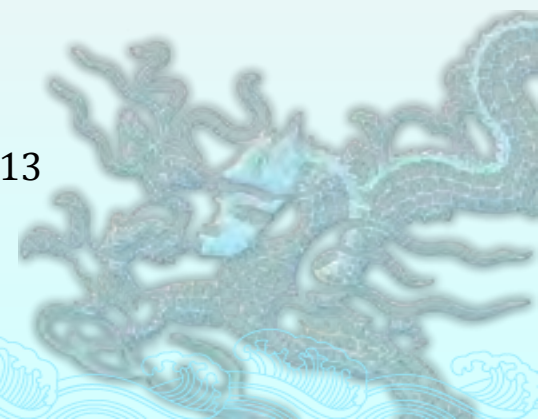
# Mail Online

## Having sex can make you BRAINIER – especially in the first flushes of love

- People in new relationships had more nerve growth, which boosts alertness
- Sex may also encourage growth of brain cells in parts of the brain responsible for memory and learning, and,
- Protect against mental decline by bringing more nutrients to the brain

By [Anna Hodgekiss](#)

**PUBLISHED:**14:18 GMT, 5 March 2013| **UPDATED:**15:38 GMT, 5 March 2013



**SPECIAL REPORT: CAN HALLUCINOGENS HEAL THE BRAIN?** page 58

SCIENTIFIC AMERICAN  
ERICA

# MIND

BEHAVIOR • BRAIN SCIENCE • INSIGHTS

Brain-  
Training  
Games  
for Kids

page 38

May/June 2019

[www.ScientificAmerican.com/Mind](http://www.ScientificAmerican.com/Mind)



# Level 1 : Right Brain Baby Foundation Skill 1

<https://www.youtube.com/watch?v=PKwKBhUawFM>

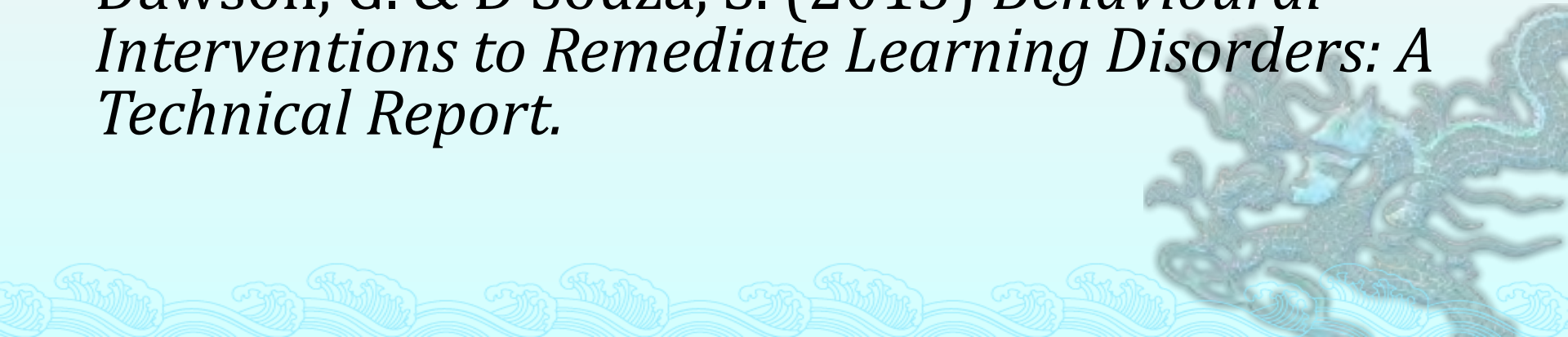


# Centre for Brain Research

University of Auckland  
School of Psychology

Marketed brain-based programs often lack sufficient scientific evidence to back up their claims.

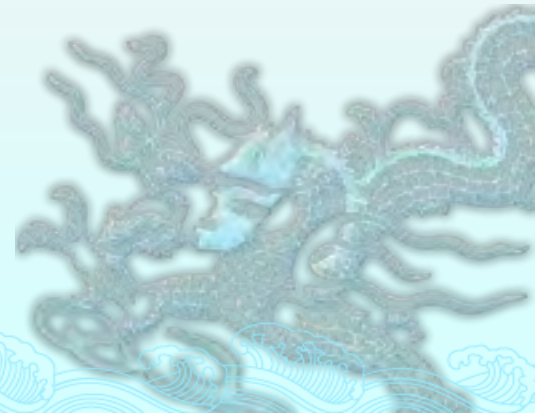
Dawson, G. & D'Souza, S. (2015) *Behavioural Interventions to Remediate Learning Disorders: A Technical Report*.



# How IS lights up the brains of its recruits

\$4 million funding from the  
US Department of Defence.

*The Age* March 2016



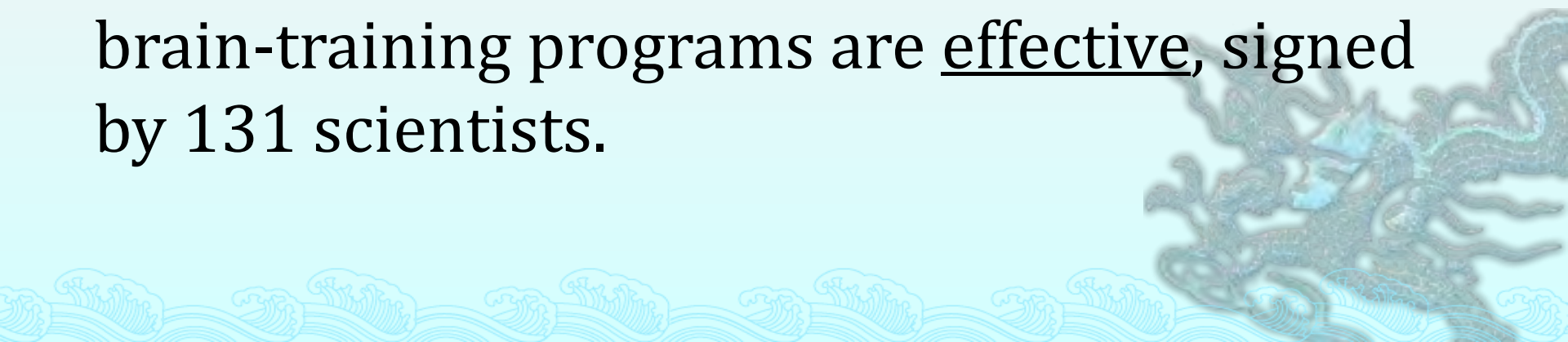
# www.theconversation.com

## The Dana Foundation

### Brain-training programs:

*Stanford Centre for Longevity* released a statement signed by 75 scientists – brain training programs are ineffective.

A 2<sup>nd</sup> scientific consensus statement arguing brain-training programs are effective, signed by 131 scientists.

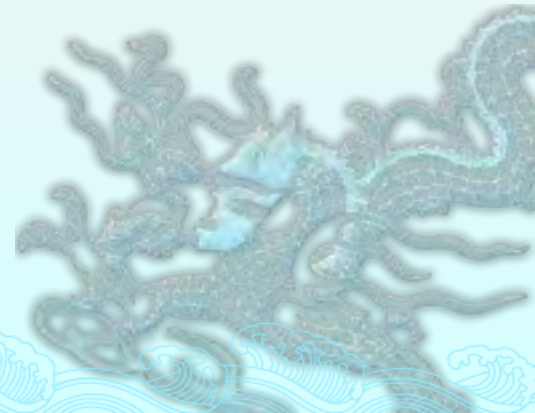


[www.theconversation.com](http://www.theconversation.com)

- ◆ Weird neuroscience: how brain research hijacked education
- ◆ Monday's medical myth: you can selectively train your left or right brain
- ◆ How neuroscience is being used to spread quackery in business and education
- ◆ So much talk about 'the brain' in education is meaningless

# Final Words

- ◆ OECD 2002/7
- ◆ Howard-Jones, P. (2008)
- ◆ Szucs, D. & Goswami, U. (2007)
- ◆ Hruby, G.G. & Goswami, U. (2011)
- ◆ Bruer, J.T. (2006)



# So Much Talk About 'The Brain' in Education is Meaningless

**by J. Cooney Horvath and G. Donoghue**  
***The Conversation* | September 7, 2015**

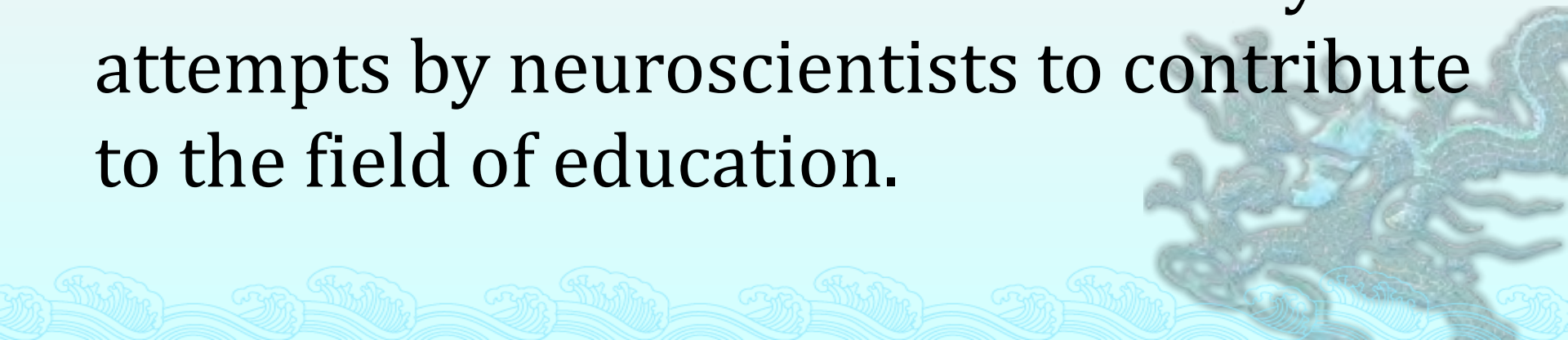
The next time you read something about neuroscience and education, there are a few simple questions you can ask to inoculate yourself against ultimately meaningless propositions.



## New Words:

***Neurosophisms*** – the majority of educational references to the brain, altho' impressive sounding, are devoid of any original, unique prescriptive value.

***Neurosnobs*** - those who dismiss any attempts by neuroscientists to contribute to the field of education.



# ACER Science of Learning Research Centre

The Australian Government's \$16 million **Science of Learning Research Centre** is bringing together education professionals and high quality researchers in areas ranging from neuroscience and cognitive development through to pedagogy and educational technology.

# Serve and Return Interaction Shapes Brain Circuitry

[https://www.youtube.com/watch?v=m\\_5u8-QSh6A&list=PL0DB506DEF92B6347](https://www.youtube.com/watch?v=m_5u8-QSh6A&list=PL0DB506DEF92B6347)

