Book summary – Neuroscience for learning and development

The book has sixteen chapters; it begins with a preface by the author, Stella Collins, exploring what has happened in the three years since the first edition of the book was published.

Chapter 1 – Why Neuroscience and Learning are Good Companions

This chapter begins by explaining who this book is intended for: 'trainers' – which encompasses many different categories of people in a range of professions. It then explains a number of reasons why the book has been written, needed to be written and needs to be utilized in organizations. For the purpose of this book and those reading it, Collins gives a definition of neuroscience "it's become a blend of many disciplines including psychology, physiology, philosophy and even computer science, engineering and physics".

Throughout the book is a feature called 'Other Voices', people that have applied concepts from psychology and neuroscience and tested them. The first of these Other Voices comes from Pam Welby, CEO and Founder of Fast Forward International.

The chapter has a guide on how to use this book – readers can read from start to finish or choose the chapter heading/subheading most relevant to them and their work. As with all chapters in the book, it ends with a summary which highlights the key points.

Chapter 2 – The Science of Your Brain

This chapter aims to give the reader a basic overview of how the brain works and how this relates to learning. It covers brain cells, basic brain anatomy, neurotransmitters and research techniques.

It has sections with brief explanations of what constitutes the brain: brain cells, neurons, glial cells, networks and blood vessels. The chapter then goes on to describe the physical structure of the brain; but with the caveat that this book is aimed at those who want to improve learning techniques, so the models presented are simplified.

The triune brain model, developed by neuroscientist Paul D. MacLean is used here; this model divides the brain into three areas:

1. The brain stem (or reptilian brain);
2. The limbic system; and
3. Neocortex (or just called the cortex)

A figure is provided describing the role of each structure. Then the three separate parts are described in more detail.

Next, the chapter explores what are known as the brain's messengers – neurotransmitters and hormones; only the ones relevant to learning are covered. These include neurotransmitters such as acetylcholine, dopamine and noradrenaline, and hormones such as oxytocin and adrenaline. It then moves on to describe different types of brainwaves and their frequencies.

Tools of neuroscience are discussed, tools that are used to see into the brain; electroencephalography (EEG), magnetoencephalography (MEG), magnetic resonance imaging (MRI), function magnetic resonance imaging (fMRI) and position emission topography (PET).

The Other Voice in this chapter is provided by Emmanuel Emielu, Managing Partner/CEO of Oil and Gas Soft Skills Ltd, Nigeria.

Chapter 3 – What to do When Someone Says 'Neuroscience Says. . .'

This chapter starts by discussing memory and age and how assuming memory inevitably deteriorates with age is not completely the case. In short, this chapter is about how research and ideas and assumptions are constantly evolving as science progresses. Neuroscience is a great example of this; what one bit of research said fifteen years ago might not be what has been discovered today.

The chapter explains that it is useful for learning practitioners to understand how scientific research works, with neuroscience; it's a constantly evolving discipline with regularly updated ideas. The idea of neuromyths are discussed or facts about neuroscience that people have oversimplified, such as the left-brain right-brain concept.

This chapter's Other Voices comes from Ben Ashton, a third-year psychology student at the University of Exeter, UK.

There is also a section about how 96 per cent of research participants in the leading psychology journals are from Western industrialized countries which accounts for only 12 per cent of the population. The message being that research outcomes might only apply to a small group of people. It also warns about cherry-picking research results to prove a chosen model or methodology.

This chapter poses six questions that need to be asked when someone says 'research shows:'

1. Who did the research?
2. What's on their agenda?
3. Where was it published first?
4. When was it published?
5. How was the science done?
6. What are the results saying?

And a bonus question – is the research relevant to what I do and can I or should I apply it?

It then gives top tips for using brain-based research such as: avoid looking for the 'one true answer', keep an open mind and take a pragmatic approach.

Chapter 4 – The Science of Learning

This chapter aims to explore what learning is, but will first start with what is isn't, and it presents a diagram representing a visual guide to the chapter. What learning isn't: it isn't development, it isn't memory and it isn't information or content. "Learning is a process by which changes in your brain allow you to behave and respond in particular ways".

The chapter describes what happens with cells, neurotransmitters and hormones when someone is learning. It then talks about psychologist Donald Hebb and his research that found we can explain behavior through brain function. Known as Hebb's Law (1949), it is effectively a description of neuroplasticity and a compact explanation of what is known as associative learning.

The actual physical aspects of using brain power are looked at; including the fact that brains need fat to function effectively.

The next topic to be examined is types of learning; behavioral psychologists divide learning into two basic types: associative and non-associative learning. The author identifies the gap in the research for understanding normal adult learning in the world of work.

Another topic touched upon in this chapter is the need for unlearning and new ideas on learning. The Other Voice here comes from Sue Daly, of Resolution for Change, in the UK.

Chapter 5 – Motivating Learners from Curiosity to Persistence

This chapter begins by looking at how difficult it is to learn when someone is not motivated; and asks the reader what motivates them. The focus of this chapter is about what is going on in a person's brain when they are in different states that help them learn, and how to get people in to that state. It makes clear that this is not a chapter about motivation, but more on how to motivate people to get their brains to learn.

It explores different states that brains can be in:

- Curiosity;
- Relaxation;
- Persistence;
- Goal orientation; and
- Creativity/playfulness.

How to stimulate these; and what these states can mean.

The Other Voice in this chapter is from Nikki Ayles, an independent capability development consultant.

Chapter 6 – Use Your Sense: Getting Information from the Outside World and into Your Head

This chapter focuses on sense and how they are inductive to learning; it will try to help trainers create multi-sensory environments for their learners. It discusses some challenges to using senses in learning, such as: some topics are conceptual and not multisensory; there is an overemphasis on PowerPoint and text-based learning and the labelling of people as different types of learners.

The chapter then explores how the senses work, and goes into more detail on each of the five main senses – sight, sound, touch, smell and taste. It next discusses some additional senses, categorized into exteroceptive – what's going on with the body's position or motion; and interoceptive – sense that tell you about what is happening inside the body. Examples of exteroceptive senses include balance, temperature and pain. Whereas interoceptive senses can include hunger, thirst or feeling sick.

Chapter 7 – Attention, Learning and Why Goldilocks Deserves Recognition

This chapter is all about attention; the brain's systems of attention, attention span and whether attention is external or internal. It explores how attention comes in three parts:

arousal, orientation and focus. Attention span is discussed next, this is a complicated and disputed field of study and there are so many factors and variables that impact on it. It then distinguishes between external and internal stimuli and how they capture a person's attention in different ways.

There are a number of ways to help people pay attention:

- Just the right level of arousal;
- Assess multisensory input;
- Get people into the flow and help time fly;
- Increase levels of self-reference;
- Increase levels of exercise; and
- Direct attention to what's important.

The chapter goes into further detail about each of these points, with background to each and how to create them. Next the chapter lists some reasons why questions are a powerful tool for directing attention:

- They increase self-reference;
- People have to recall information;
- Tend to promote eustress (optimal level of stress); and
- Influential as to where we place our attention.

Chapter 8 – Making Learning Meaningful and Valuing Intelligence

This chapter begins by discussing intelligence and how it is regarded; starting from in school, but also talking about how someone who isn't good at a topic or a subject isn't necessarily unintelligent.

It explores different types of intelligence beyond traditional IQ, some other types of intelligence are:

- Linguistic;
- Logical-mathematical;
- Visual-spatial;
- Body/physical;
- Musical;
- Interpersonal;
- Intrapersonal; and
- Naturalist.

The Other Voice in this chapter comes from Nicki Davey, Director at Saltbox Training and Events, Ltd., where she discusses using nature to enhance learning.

There are some takeaways in this chapter relating to the discussion of multiple intelligences; seeing learners differently, adopting a growth mindset, growth and grit, teach the intelligence to your learners, use Multiple Intelligences as a framework to notice and adapt what you do and work with and against your preferences.

Chapter 9 – Meaningful Memories: from encoding to forgetting

This chapter focuses on memory, something so essential to learning but is far from being fully understood. It begins by looking at the two types of memory – explicit and implicit and how they are processed differently in the brain. Explicit memory processing has four stages: encoding, storage, retrieval and forgetting.

The Other Voice in this chapter comes from Ann Grindod of Simply Learning, UK.

Next the chapter suggests some methods that could help people remember:

- Links;
- Emotion;
- Anchoring learning;
- Repetition, repetition, repetition and meaning;
- Novelty and meaning;
- Stories and meaning;
- Organization and chunking; and
- Smell.

Chapter 10 – Testing, Experimenting, Habits and Practice

This chapter explores why to test learning as well as how to test, where and when to do it. Testing is an effective part of the learning process and can help improve performance. Testing can also help improve levels of confidence and motivation in a learner, it can also help people make adjustments, for example, when learning a new skill. The chapter then discusses the neuroscience of habits; as testing can aid in breaking, forming and changing habits. There is methodology known as CARS in relation to changing habits: Cues, Actions, Rewards, SIMPLE ideas; (Small steps, Increase your efforts, Missing an action, Practice regularly, Link to other habits and Environment).

The chapter then explains all the benefits of testing but warns of the consequences of it not being done well. It lists some ways to test as part of the learning process:

- Teach someone else;
- Drawing as a test; and
- Practice.

The Other Voice in this chapter comes from Dr Darja Mirt, DVM, PhD and how they have been using Brain Friendly Learning for more creative workshops.

The chapter then explores some issues about testing which causes it to get in the way of learning – reduces intrinsic motivation and increase of stress during recall.

Chapter 11 – Getting Rid of the Magic Wand: The Truly Terrible Training Course

This chapter explains how reverse psychology works when trainers are asked to design a truly terrible training course from the perspectives of the learners, the trainers and the organization. In essence, the chapter is all about reflecting on and reviewing learning so that it is absorbed; this is one of the most valuable, but frequently overlooked, areas of design and delivery and may be one that needs a cultural change within an organization.

The chapter discusses what happens to a person's brain when they review learning, how to review effectively and some challenges that can impede reviewing.

The Other Voice in this chapter comes from Sandra Lace, Head of Training Academy for an International Bank in Latvia.

The next part of the chapter is all about how and when to review learning and gives a number of top tips:

- Use the multiple intelligences as a framework for reviews that reflect different topics and different people;
- Make reviews short and snappy so that they fire up neuronal pathways;
- Encourage people to actively review and recall their learning;
- Schedule reviews so they become a normal process; and
- Educate learners so they know that you don't have a magic wand.

Chapter 12 – Stickier Stories and Food for Thought

This chapter covers how stories – as opposed to simply stating facts – can help people learn; stories have structure and they are also relatable and have relevance for learners.

Next, it examines language and learning and provides five neuroscience tips that will help make a trainer's language and messages more accessible:

- Keep it simple;
- Prime the brain with what you want;
- Highlight compliant behaviors;
- Say 'yes' rather than 'no'; and
- Metaphors touch your multisensory brain.

The Other Voice in this chapter comes from Krystyna Gadd, Founder of How to Accelerate Learning, UK, and she discusses using Clean Language to create a safe environment.

The chapter then moves on to how conductive an environment can be to the learning process. It looks at important factors and the impact they have such as, color; natural light; what a learner eats and drinks; and a creative/playful environment.

There is a second Other Voice here and it comes from Helen Ashton, Senior Learning Consultant, First Class Learning and Development.

Next, the chapter looks at music and how it is a useful tool in creating different emotional environments in a learning situation, and more specifically about 'ear worms'.

Chapter 13 – Sleep and Learning

This chapter is all about sleep, what happens to the brain when a person is sleeping and the essential role sleep plays in learning; especially in regards to memory consolidation and sense making.

It explores the different stages of sleep, as well as what impact different parts of the brain and different chemicals have on sleep. It then explains the consequences of not getting enough sleep and its relationship to learning.

The Other Voice in this chapter is from Dr Paul Kelley, Honorary Associate at the Open University.

It then looks at what organizations can do about delivering learning when people are tired, firstly stating that there needs to be an awareness at the organizational level. It then looks at what trainers can do for their learners.

Chapter 14 – Your Brain and Digital Learning

This chapter is all about digital learning and covers concepts such as: how digital technology affects the brain, virtual reality learning, social digital learning and provides practical guidance for the design and delivery of digital learning.

The chapter then lists a number of benefits associated with digital learning. It then explores two different types: virtual reality learning and social digital learning. It next explores some features of the digital world that aren't conducive to learning, such as; fear of technology, information overload, excessive choice, lack of flexibility, exposure vs learning, lack of emotional connection and reading difficulty.

On the other hand, a number of concepts are explored about the digital world that should aid learning:

- Predictability;
- Effective spaced learning;
- Effective use of AI;
- Availability;
- Create knowledge producers; and
- Create and solve problems.

The Other Voice in this chapter is from Emma Livingston-Jones, Learning Specialist, Humanitarian Leadership Academy.

Next comes some top trumps for designing and delivering digital learning:

- Interactive trumps passive;
- Participant control trumps tutor control;
- Social trumps solitary;
- Recall trumps recognition;
- Explore trumps click; and
- Guessing trumps being told.

Chapter 15 – The Future is Already With Us

The chapter begins by discussing mindfulness, a very current topic in conversations about health and wellness in general and particularly at work.

It then looks at three ideas for the future of neuroscience: the quantum brain, computational neuroscience and smart drugs, and explains more about each.

Chapter 16 – The End of This Journey and the Start of More

This concluding chapter explains how, in the author's opinion, L&D professionals in the 21st century are like the London Tube (or any other rail system). In essence, the role of an L&D professional is to take people from one place to another whilst they continue to do their key role.

This chapter reviews key concepts from the book and is how about how the reader can begin to put what they have learnt into action. It also explores some challenges of putting neuroscience into practice. After discussing challenges, it then describes the benefits of applying practical ideas from neuroscience.

At the end, it lists some top ideas to take away:

- Never do for the learner what they can do for themselves.
- There's no such thing as a boring topic – only boring training.
- You don't have to be a neuroscientist.
- Learning isn't all about 'fun'.
- Challenge poor practice.
- Create learning environments rather than courses/content.

Reference

Collins, S. (2019), *Neuroscience for Learning and Development: How to Apply Neuroscience and Psychology for Improved Learning and Training*, 2nd ed., Kogan Page, London, available at: www.koganpage.com/product/neuroscience-for-learning-and-development-9780749493264