PART II
Core concepts of effective learning

SOMMARIO: 1. Neuroeducation: where the brain meets education **- 2.** The learning environment makes a difference **- 3.** Factors influencing learning **- 4.** Memory **- 5.** Learning engagement **- 6.** Life-long learning **- 7.** Accelerated learning systems **- 8.** 21st century skills

1. Neuroeducation: where the brain meets education

All human abilities, including learning, are a result of our brain activity. Hence, a better understanding of how our brain operates can result in a better understanding of learning. Researchers in neuroscience are confirming theoretical positions advanced by developmental psychologists for many years as, for instance, the importance of early experience in development. If developmental psychology, cognitive psychology, and neuroscience have mainly contributed a great number of studies, aspects of learning and development have converged now in a more complete picture of how learning occurs in our brains. The advent of non-invasive imaging technologies, such as *Positron Emission Tomography* (PET) and *Functional Magnetic Resonance Imaging* (FMRI), has allowed researchers to observe human learning processes directly and see what part of the brain is actually active when performing a particular task. As a result, today we know much more about learning than ever before, and this understanding provides professionals with great opportunities for training and development of new insights. At least three elements of evidence came from these studies:

- Learning changes the physical structure of the brain.
- Structural changes alter the functional organization of the brain.
- Different parts of the brain may be ready to learn at different times.

From a neuroscience perspective, instruction and learning are very important parts of a child's brain and psychological development processes. These involve continuous interactions between the child and the external environment. In learning situations, implications of this interactive process also suggest considerations as how much depends on genes and how much on environment. Neuroscientists have demonstrated that learning specific tasks activates

localized changes in the areas of the brain appropriate to the task, which underlie modifications in the functional organization of the brain. That is, learning imposes new patterns of organization on the brain, and electrophysiological recordings of the activity of nerve cells have confirmed this phenomenon. Research studies on brain development provide a model of the learning process at the cellular level: the changes first observed in rats have proved to be true in mice, cats, monkeys, and birds and they almost certainly occur in humans too.

Furthermore, recent data have been showing that the brain continues to change over the course of our lives. Cells keep growing and form connections with new cells and, together with nerve cells, other brain cells shift and change as we learn. Scientists have now begun revealing the secrets of how we learn even within individual cells, showing us that the brain is incredibly *plastic*, does not harden at age 25 but remains steady for the rest of our lives. While children learn certain things, especially language, more easily than adults do, older adults can expect real transformations associated with learning processes and this evidence consistently supports the chance of a life-long learning process for all individuals.

We sometimes refer to our brains as *grey matter* because, from the outside, the brain looks mostly grey. However, there is a large amount of *white matter* in our brain filling nearly its 50%. This white substance is myelin, which scientists now claim to increase the speed and strength of the nerve impulses. *Myelination* occurs naturally, mostly during childhood. Kids are like myelin generating machines, absorbing information about the world and themselves. As we get older, we can continue to generate myelin, but this happens at a slower rate and requires more effort. Another strong point in favour of myelin's performance-enhancing abilities is what happens when it is missing. *Demyelination* is a known factor in multiple sclerosis and other neurodegenerative diseases that cause symptoms such as loss of dexterity, blurry vision, loss of bowel control, and general weakness and fatigue. This suggests that myelin is an important factor in allowing us to make the most of our brain and bodily functions. Understanding the role of myelin means understanding not only why repeated practice is vital to improving individual skills but also the quality of this practice. Research findings ultimately validate the phrase *practice makes perfect* often used by teachers to encourage their students to increase their efforts in order to learn to do something very well. This is due to the brain's neuroplasticity, its natural ability to grow new skills and continuously learn. Young children are ready from birth to master skills intuitively.

In *learning happening*, real-life experiences implement and exercise the mind

through. Once skills have been developed, they are enabled to develop further through practice. The *flow experience* is intrinsically rewarding, there is a sense of timelessness and deep connectedness with the activity and the context, as our full attention is given to the task at hand. Such experiences have been described as evidence of a *growth mindset*, a positive attitude toward learning that leads to more practice time and greater skill development. Formal school instruction is bound to be unsuccessful if it fails to support and encourage this natural *self-constructive* learning process. In order to achieve meaningful skills, comprehension to develop knowledge must be practised and applied. It is only through their continual application that ideas are transformed into deep comprehension, real ability, and useful real-world skills. For this reason, it is essential for people of all ages to train their attention and experience positive emotions while they are learning.

The connection between neurological findings and educational implications resulted in the emergence of a new, interdisciplinary field of study called *neuroeducation*, or *educational neuroscience* originated in the '90s to explore the interactions between biological processes and education. Neuroeducation provides a scientific method for curriculum design and teaching strategies for a more objective understanding of learning based on evidence using the latest findings from neuroscience, psychology, and cognitive science.

A significant objective of this field is making the latest findings accessible and practical to educators and policymakers, who generally come from non-scientific backgrounds. This includes addressing any popularized *neuromyths* and other misunderstandings about how our minds work. Among the main subjects of neuroscience, there is the role of emotions in learning. We know that negative emotions such as fear or stress can have a negative effect on the learning process. On the other hand, teachers may have noted the powerful and positive impact that passion-based learning can have. These results also encourage supportive and cooperative groups to increase memory retention along with pleasure, motivation, perseverance, and resilience.

2. The learning environment makes a difference

Learning theory does not provide a simple recipe for designing effective learning environments. Nevertheless, new developments in the science of learning suggest important questions about the design of learning environments as well as the importance of rethinking contents and manner of teaching and assessment. Learning goals for schools underwent major changes in the past century. Everyone now expects much more from education than a

century ago. A fundamental principle of modern learning theory is that different kinds of learning goals require different approaches to instruction, and new goals for education require changes in opportunities to learn. This shift should be kept in mind when considering claims that schools are *getting worse*. Actually, researchers suggest that, in many cases, schools seem to be functioning as well as ever, but the challenges and expectations have changed dramatically. Today, students need to understand the current state of their knowledge and to build on it, improve it, and make decisions. In view of this, the term *learner centred* is used to refer to environments that pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting. Overall, learner-centred environments include teachers who are aware that learners tend to construct their own meanings, beginning with the beliefs, understandings, and cultural practices. If teaching has to be conceived as the construction of a bridge between the subject matter and the student, learner-centred teachers are aware of the two sides of the bridge. Skilled teachers give learners respect and recognition assuming that these factors can serve as a foundation on which to build bridges to new understandings. Moreover, developing an engaging and positive learning environment for learners, especially in a particular course, is one of the most creative aspects of teaching. Typically, the focus is either on the *physical institutional environments* like lecture theatres, classrooms, or labs; or on *different technologies* that are used to develop online learning environments.

The physical characteristics of learning situations affect learners emotionally, with important cognitive and behavioural consequences. Environments that elicit positive emotional responses and wellbeing

in school may lead not only to enhanced learning but also to a powerfully emotional attachment to that space. Clearly, some learning environments are more comfortable and offer fewer distractions, while physical characteristics that cause discomfort are likely to interfere with learning. Educators may also argue that learning environments have both direct and indirect influence on student learning, including their engagement in what is being taught, their motivation to learn, and their sense of well-being, belonging, and personal safety. For example, learning environments filled with sunlight and stimulating educational materials are sensibly more conducive to learning than dull spaces without windows or decoration. The areas of psychology most directly related to classroom design and learning environments are environmental, educational, human-factors engineering and social psychology. Previous research on the effects of such environmental variables as light, temperature, and noise on learning has yielded some anticipated results affecting traditional classroom design. Yet, *learning environment* is a broad expression including

several components. The term relates to:

- Learners' **characteristics**.
- Learning and teaching **goals**.
- **Activities** that support learning.
- **Assessment** strategies that drive and measure learning.
- A culture that directly infuses a learning **environment**.

Social, physical, psychological or cultural factors involved in a learning environment deeply affect the learners' capabilities. If the learning atmosphere is not contributing to gain new knowledge or skills, it will be hard for learners to remain immersed or interested. For example, stress significantly affects cognition and, when it combines with learning processes, the negative effects outweigh the positive ones. Stressed learners find the learning environment more like a threat to their self-esteem than a place to improve or learn new skills. Instructors hold the responsibility to incorporate an array of strategies that would protect learners from the negative attitude by providing enough positive experiences. How adults interact with students and how students interact with one another must also be considered features of the learning environment, and phrases such as *positive learning environment* or *negative learning environment* are commonly used in reference to the social and emotional dimensions of a school or class.
In sum, the term *learning environment* does not refer to a single procedure but to the diverse physical locations, contexts, and cultures in which students learn. Since students may learn in a wide variety of settings, such as out-of-school locations and outdoor environments, the term is often used as a more accurate or preferred alternative to *classroom*, which has more limited and traditional connotations indicating a room with rows of desks and a chalkboard. On the other hand, the term also encompasses the culture of a school or a class, its dominant ethos and characteristics as well as the ways in which teachers may organize an educational setting to facilitate learning. And, because the quality and characteristics of a learning environment are determined by a wide variety of factors such as school policies and governance structures, even other features must be considered as essential elements of a learning environment.