The science of learning

Geoff Masters explains how an emerging field of research is improving our understanding of how students learn.

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Advances in our understanding of human learning are challenging long-held assumptions about education.

For example, it was once was believed that individuals differed significantly in their capacity to learn. However research in neuroscience has shown how the plasticity of the brain enables almost all individuals to learn throughout the lifespan. In schools this means that, although students are at different points in their learning and are progressing at different rates, almost all students are capable of successful learning if motivated and if provided with appropriate learning opportunities and support.

The emerging multidisciplinary field of the science of learning integrates neuroscience, psychology, complex systems, educational research and classroom teaching practice to build a deeper understanding of learning processes. ACER is collaborating with the Queensland Brain Institute to establish Australia's first Science of Learning Centre.

Based jointly at the University of Queensland and ACER, the Centre will be a cross-disciplinary initiative to identify, research and understand effective teaching and learning practices in the light of current knowledge about basic learning processes and factors that influence successful human learning. The Centre also aims to advance research into, and knowledge about, learning itself.

The Centre will comprise researchers with backgrounds in neuroscience, psychology, education, imaging and complex systems. Research in each of these disciplines is contributing to a better understanding of ways to support successful school learning. The Centre will employ state-of-the-art brain imaging technology and modelling techniques to synthesise findings across disciplines.

At a micro-level, research in neuroscience will explore how learning leads to changes in the structure of brain cells and in the manner in which cells interact in brain circuits. At an intermediate level, research in psychology and cognitive neuroscience will explore how learning is associated with changes in simple behaviours and motivation that are reflected in changes in neural activity in the brain. At the most global level, educational research will explore learning as the acquisition of complex knowledge and skills and resultant changes in observable behaviour.

The Science of Learning Centre's research program will explore these different aspects of learning simultaneously, involving a range of researchers, tools and techniques from across the research spectrum.

The role of emotions and beliefs in learning

In July 2011 the Science of Learning Centre held its first meeting. At that meeting, I reviewed research on the role of emotions and beliefs in learning.

Research in neuroscience and cognitive psychology has revealed that people are more likely to learn and to remember if intrinsically motivated and emotionally engaged. In classroom settings, learning is promoted by 'learning cultures' in which all students are expected to learn successfully, are highly engaged and feel safe and supported in their learning.

Conversely, negative emotions such as stress and fear of failure have been shown to impede learning and memory. In classroom settings, these emotions can be the result of 'performance cultures' in which learning is extrinsically motivated and students compete with each other for success.

Other research has shown the importance of positive attitudes and beliefs about learning. Learners are more likely to learn successfully if they believe that they are capable of learning – in other words, if they have positive views of themselves as learners. They also must believe that effort will result in success.

Learning is maximised when tasks are targeted just beyond individuals' current levels of attainment – in the region where success is possible, but often only with scaffolding and support. In mixed-ability classrooms, students learn best when provided with learning opportunities matched to their varying interests and progress.

Progress in our understanding of learning is challenging long-held educational theories. Another example is the general acceptance in society that not everybody can excel. Not everybody can be an Olympic athlete, just as not everybody can be tall. By analogy, it is argued, not everybody can (or even should) achieve excellence in the learning of mathematics or languages or science.

However, educational achievement is not pre-determined in the way that attributes such as height are pre-determined. Just as levels of health, wealth and educational participation have increased in the general population over time, there is no reason why the percentage of students achieving excellence also should not increase.

Achievement is strongly influenced by the quality of teaching. Improved understanding of learning processes will lead to more effective teaching practices, which in turn will create better educational outcomes for young people.

Further information about the Australian Science of Learning Centre is available from <**www.qbi.uq.edu.au/solc**> ■