EDITORIAL

What does technology add to learning?

Debates abound about whether learning is changing through digital capabilities. Learning has always happened in varying degrees and the neuroscientists are increasing our understanding of the biochemical and electrical activities which make this happen in the brain, exploring the neural processes involved in learning. Does digital activity, particularly long spans of screen focus, affect how this learning happens? A paper published by the Royal Society (West et al., 2015) suggests structural changes can occur in the ever plastic brain through regular video game playing, changes which may be associated with a risk of neurological and psychiatric disorders later in life. This is just one paper, and the conclusions are far from conclusive, but there are some warning signs that neural activity, being very flexible, may adapt to excessive use of screen and touchscreen interaction, and not always in a good way.

So perhaps we should be concerned about the effect technology can have on learning. While brain structures and linkages will adapt, and, for some stimuli, return to their previous state when the stimulus is no longer encountered, the laying down of memories and the augmentation of knowledge and skill still happen through enquiry, interaction with the environment and rehearsal. Learning technologies of the kind discussed and explored widely in this journal tend to focus on the enhancement of enquiry and rehearsal motivation, often looking for the marginal gains which will make a difference.

According to the Royal Society's publication on Neuroscience: Implications for education and lifelong learning (2011), research demonstrates that uncertainty about the reward the learner might receive contributes to the level of neural response it generates. This seems to challenge any simple relationship between reward and motivation in school, and could offer new ways to use reward more effectively in education to support learning. Using games which can adapt to a learner's skill level can be a particularly effective way to demonstrate the difference between the outcome the learner expects and the outcome they actually achieve. In a virtual environment this can encourage practice and rehearsal, personalising through adaptive routines to the learner's needs in a way which would be difficult to achieve in a traditional didactic classroom.

A whole range of other opportunities derive from technology which could be said to add value to learning. Digital simulations are offered in a range of disciplines from medicine to mathematics and business to the creative arts, enabling experimentation without danger, and access to hands-on learning experiences which would otherwise be unavailable. Calculations can be similarly manipulated online, easily producing an endless set of examples with randomly introduced data; this allows practice and rehearsal of arithmetic processes, often made more attractive by innovative visual display. Videoconferencing has made it possible for learners at every level to connect with people remotely and have conversations directly with those living in contexts they would formerly have met only through textbooks. This is a huge boost for language learning as well as all forms of educational research and interaction. Digital cameras and other sensors enable real time observations for data gathering.

Applications enable learners to relate differently to real world environments through augmented reality. At the same time, passively collected data about their use of applications enables learning analytics to enhance and guide our understanding of attention, activity and engagement in learning. This means educators can offer support in good time when it is needed, rather than waiting until assessment failure flags up a problem. Learners can take greater responsibility for their own learning, initiating video, blog and messaging of all kinds to produce their own artefacts both individually and through collaborative projects which are easily shared and evaluated. Problem based learning can make use of real world contexts remotely to enable skill-building and interdisciplinary work on authentic problems. And this great list of benefits does not scratch the surface of the information search revolution through the Internet.

So we might reasonably suggest that technology does add value to learning, with the proviso that these large leaps forward in technology enhanced learning will bring their own costs and perhaps dangers. Excessive screen reading has been mentioned above, which may affect brain structures but also eyesight, social relationships and other skillsets which may be neglected, particularly when mobile devices are used at a very young age. The affordance of a touchscreen to give instant gratification, not just through gaming but also children's educational software, is beginning to affect every child and may have repercussions in later educational stages where reflective, critical and analytical activities involving delayed gratification may be harder to learn.

This is why so many of the articles published in this journal are relevant to increasing our understanding of the impacts of learning technologies. In this issue we have papers touching on many of the value-adding features mentioned above including mobile learning, augmented reality, learnergenerated artefacts, multi-touch technology, knowledge-building and video games. We need to learn fast about the value technology can add to learning, but we also need to look ahead to notice and mediate any future dangers to our brains and our society.

References

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