PORTABLE BRAIN TECHNOLOGIES IN EDUCATIONAL NEUROSCIENCE RESEARCH

AN EARLI RESEARCH STORY

In 2020, EARLI launched a new initiative to increase visibility for the excellent research conducted by EARLI members: the EARLI Research Story. Every other month, an EARLI member or group of EARLI members is offered the opportunity to share their research initiatives and findings in a short blogpost or video. This month: the researchers behind the EARLI Emerging Field Group on Portable Brain Technologies in Educational Neuroscience Research.

Two years ago, we had the honour and opportunity to start one of the first four Emerging Field Groups (EFG), supported by EARLI and the Jacobs Foundation. Our EFG consists of a diverse group of cognitive neuroscientists, all interested in exploring the use of mobile neuroimaging technologies to study real-world learning. In this short research story, we will take you with us on a journey from the lab to the real-world.

Imagine being a teenage participant in a typical neuroscience experiment. You take a seat in front of a monitor (or you lie down, in the case of fMRI) in a secluded room. In this case it's an electroencephalography (EEG) experiment, and after some very specific instructions, you watch hundreds of stimuli appear, one after another. You need to count infrequent O's intermixed with frequent X's. With this 'Oddball Task', attention is measured for the oddball stimuli (O's), and although simple in its setup, it's immensely popular among researchers. Now imagine being back in high school, sitting in a noisy classroom, interacting with a friend nearby, while listening with half an ear to the teacher's instructions. Do you see a discrepancy between the two examples?

As the field of educational neuroscience has grown, questions have emerged regarding the ecological validity and applicability of lab-based research to educational practice. Although a widely recognized problem, finding solutions remains challenging. Some research groups try to tackle this problem by bringing 'the real-world to the lab', pursuing new paradigms that better represent the real-world ecology. Others, like our EFG group, commit themselves to do the reverse: bringing 'the lab to the real-world'.

Advances in mobile neuroimaging technology, such as portable EEG and functional near-infrared spectroscopy (fNIRS), have played a key role in allowing this new approach.

Three quite different examples from our EFG can clarify what this may look like. First, in a pioneering study by Suzanne Dikker and Ido Davidesco, twelve high school students followed biology lessons in their classroom over one semester while wearing mobile EEG. Remarkably, from earlier research we know that brain waves synchronize during shared activities; this was uniquely replicated here as well. Synchrony was related to engagement, teaching style and teacher likeability. Another ongoing study by Tieme Janssen and Nienke van Atteveldt, used mobile EEG neurofeedback in 12 classrooms. High school students had very powerful experiences of being in control over their own brain, which may help to internalize the growth mindset message in this intervention. Lastly, Kaja Jasinska used mobile fNIRS to increase inclusion in science for communities who, to date, have largely remained excluded from scientific research, such as in rural sub-Saharan Africa (SSA).

The exciting opportunities of mobile neuroimaging come with their own challenges. What we gain with ecological validity, we lose with experimental control. Another important challenge is to develop new paradigms that work well outside the lab ('naturalistic design'). Lastly, we realize that these technologies also come with ethical challenges that need to be addressed with all stakeholders. Our EFG plans to publish a review article next year to further share our vision of this nascent field, and we hope to welcome you to future symposia and workshops.

Further information
EARLI.org/EFG