Special issue: Innovative Teaching Personal Essays

Passive to Active Learning: Engaging Students with a Technology-Based Learning System in Physiology

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I have been teaching in higher education for 28 years, during which time I have experienced significant change in student cohorts. My teaching philosophy incorporates a desire to enrich the first year experience, share my love of science, and engage students in a range of learning contexts to accommodate and support learning. As a lecturer to first year students, I teach foundation knowledge and help students to develop critical thinking skills. Foundation material can sometimes be perceived as irrelevant and difficult to comprehend, promoting passive learning and often, disengaging learners, and so, I continually seek to provide fun, yet academically rigorous learning experiences. I believe that first year students can be active, rather than passive learners, and can develop into confident, deep learners. During the last 28 years, the challenge to engage students actively in foundation material has enabled me to transform my teaching, utilizing technology to enable authentic student learning (Herrington and Herrington 2006).

Students of the digital age have encouraged me rethink how I teach with innovative online resources such as games and quizzes, now essential supporting elements of learning in my units (Douglas, Salter and Capstick, 2011). Technology has been shown to positively influence student engagement and self-directed learning (Rashid and Asghar 2014) and enables me to shift

from a teaching-focused paradigm to a learning-focused paradigm. This enables students to become self-directed learners. In laboratory settings, the integration of active learning engages students with technology in an area I love to teach, physiology, a difficult discipline for many students as it requires understanding rather than memorization. Historically, physiology is taught using traditional equipment (such as sphygmomanometers for blood pressure recording) but, in 2009, we were approached by ADInstruments to consider the implementation of a data acquisition and e-learning system, LabTutor®, using Powerlabs in laboratories. I, and like-minded colleagues, immediately saw an opportunity to stimulate student curiosity and enhance student learning, and so, with the financial support of the School of Human Life Sciences (HLS), I began to incorporate LabTutor®, into my physiology curriculum. LabTutor® provides online laboratory teaching using specific experiments across a range of anatomy and physiology topics that can be customized to specific curriculum needs (Vazquez 2008). In 2009, little evidence existed regarding the use of LabTutor® in effective teaching practices, but it has since been reported to guide fun, independent learning in bioscience for nurses (Swift, Efstanathiou and Lameu 2016; McMullan 2017) and to provide experimental data to enhance referencing skills in first year biology (Chunduri et al. 2014).

Using LabTutor®, students record and analyze real physiological data (such as blood pressure, muscle contractions, etc.), and are able to "see" physiology happening, understand the underlying concepts and apply it accordingly. Staff feedback is positive, "… students actually got visual feedback as they were completing the prac which assisted them in their understanding of the physiological concepts…" (email from tutor, 2010). However, initial student feedback was mixed due to initial technical problems and I realized that, in this digital age, students are not in the habit of reading instructions!

In 2010- 2011, only 45% of my students agreed that the LabTutor® based practicals reinforced their learning in muscle and nerve physiology. This was partly due to a number of technical errors experienced during initial implementation; "the technology for LabTutor is difficult to use and doesn't always work", (student comment, 2010). Despite this, I, and my colleagues) were motivated to continue to review and improve the use LabTutor® as it enabled real data production that could be analyzed for assessments such as laboratory reports. In recent years, mixed feedback was received from students; "Labtutor was sometimes beneficial but not all the time." (survey comment 2013) "Labtutor labs need to provide more questions that allow for developing of understanding." (survey comment 2014) "Labtutor also needs to be improved, tutorial time was often wasted from simply trying to get labtutor to load." (survey comment 2017). However, some students could see the value of the software when it worked, "LabTutor is hard to grasp but is amazing as it allows us to instantly see our experimental results", (student comment, 2010), "I think that the data we can generate from LabTutor is interesting and can help us to understand concepts" (student comment, 2016). In 2012, I witnessed my students using LabTutor® and comparing it with measuring blood pressure with a sphygmomanometer. One student had a 'light bulb' moment when they realized what LabTutor® was actually measuring and the data that they were consequently generating.

This impact on student learning reinforces my enthusiasm to continue to use technology as an active learning experience. Students in latter years fully recognize its value; "As I used LabTutor® in my latter exercise physiology units I realized how valuable it is to enable you to record, analyze and interpret a range of physiological date quickly and effectively." (3rd year student comment, 2016). Improvements in student learning (based on assessment results) and positive feedback from students in advanced physiology units buoys my enthusiasm to sustain its

use in first year and I share this with current students to engage them in technology-based learning tools.

ADInstruments have just released a cloud-based interactive version of LabTutor (Lt®) for us to trial that has improved our classroom experiences in 2018. In 2018, our students and tutors are showing positive behaviors towards the technology, engaging in experiments and appreciating the interactivity and online support provided in Lt®. I strongly believe that this will further enhance student engagement and learning in first year physiology.

The acquisition of the technology, originally funded by the former HLS, is now supported by the School of Health Sciences. To warrant its purchase, Lt® needs to be incorporated into more than one academic unit as the School pays an annual subscription per student for online use of the system. Consequently, I have not been the sole implementer of this technology in our School as it is utilized in other physiology-based classes, and we are reviewing its potential for introductory biochemistry and cell biology units. ADInstruments provide ongoing support and training for professional development of staff and, despite some student resistance, faculty support has been strong throughout the journey, easing the implementation process. As we move into the next phase of the upgraded Lt system, I am excited by improved student engagement and learning as the new technology offers integrated student and staff support and enhanced accessibility for revision and assessment purposes.

As I reflect on the use of this technology in my classes, I acknowledge the importance of carefully designing and constructively aligning learning activities to ensure they enable effective, supported learning. It is still imperative to walk students through key concepts in class as they will not necessarily read pre-laboratory information prior to attending practical sessions! At the end of the day, I cannot please all of my students, but with Lt®, I can provide them with a

laboratory-based experience that will engage them in learning foundation material, stimulate their curiosity and enable them to discover in a way they did not think possible.

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