



Object-Based Learning Rocks! Integrating Digital Solutions into Geology Practicum

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Over several years, the authors have pursued technology solutions to the difficult arena of moving geology practicum work into the online space (e.g., Tetley and Daczko, 2014). Through a partnership of teaching academics with professional staff trained in digitisation and software development, the authors have now solved the problem of verisimilitude and utility and opened a raft of future opportunities including a smooth and seamless transition to online teaching when presented with recent pandemic lockdowns.

“Teaching geology with digital tools advances students’ learning experience by providing access to high-quality outcrops, enhancing visualization of 3D geological structures and improving data integration.” (Senger *et al.*, 2021) Our solution required innovation on several fronts. Firstly, 3D digitisation and gigapixel imaging processes and methods were tried, evaluated, abandoned and refined until an ideal solution was developed that could actually replace the physical rock hand samples. Secondly, software platform development and integration was required. We utilised a custom developed 3D platform (Pedestal 3D) and also developed a bespoke platform for virtual petrographic microscopy (ImageMatrix). Finally, as “the organisation, logistics and relevance of an OBL session is critical to its efficacy” (Chatterjee and Hannan, 2016), all of this needed significant pedagogical underpinning and integration to ensure learning and outcomes were not impacted by the technology shift.

We found that generally, digital resources allow for and encourage much more practice of the professional skills required for identification of minerals. “Most professional geoscientists spend much of their day in front of work-stations, interpreting or modelling digital data, in two or three dimensions.” (Bond and Wightman, 2012) so this mode of delivery is a naturally suited authentic task. On top of that, digital pre-lab work prepares students for being confronted with actual samples. Being able to digitally annotate the samples allowed for a virtual “guide on the side” pedagogy to allow for clarity of tasks and identification of specific object traits that are difficult in the traditional practical setting.

The three main areas of impact were in Workshops, Field Trips and general Practicum. The specific mineral identification workshops were extended in a blended sense pre-COVID-19 and then seamlessly moved to online when required during the pandemic without any further development. Geological fieldwork traditionally has several core functions. “These include the determination of the geographical location of observation points, the description of outcrops, the macroscopic description of rocks, the detection of lithological boundaries, the spatial fixation of planar and linear objects (folds, joints, faults, linear position of minerals, etc.).” (Bubaniak *et al.*, 2020) To respond to this digitally, a landmark yearly field trip in the program was developed into a fully online virtual field trip. The general practicum across the course was enabled to be taught in an online only mode which had never been possible before.

We found that grade distribution did not suffer during the COVID-19 period which demonstrates that this mode of Digital Object-Based Learning is as good as traditional approaches to teaching. Although not originally intended, coursework could now also be offered fully online which opens a range of possibilities moving forward.

Keywords: OBL, Geology, Practicum, Online, 3D, Edtech, Digital

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