A Comparative Study of Blended and Online Learning using the Virtual Microscope for Earth Sciences

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The Virtual Microscope for Earth Sciences (VMfES) was launched as a freely accessible 100 thin section collection of igneous, sedimentary and metamorphic UK rocks in 2012 at www.virtualmicroscope.org . The samples can be explored by panning, zooming and rotating within a browser window and can thus be viewed on many desktop and mobile platforms. Since 2012 the VMfES has increased to over 1000 samples, including rocks from around the world, meteorites and a rapidly expanding Moon rock collection.

The use of virtual microscopes (VMs) is already commonplace in Higher Education, although the field is dominated by life science VMs but VMs for Earth science and material science are less common because of the requirement for varied lighting conditions (ppl and xpl). The largest group of users of the VMfES are undergraduate students studying Earth Materials, directed to the website as extensions of their microscope laboratory classes. Students are commonly given additional materials allowing them to supplement their recognition and identification skills.

Previous studies have found that students are generally satisfied with the use of VMs, but it is not yet known what teaching and learning conditions better support their use and lead to enhanced learning outcomes. The aim of this study was to evaluate the integration of the VM in both blended and online only learning conditions and draw conclusions about the factors that should be considered in teaching and learning using VMs. Data were collected from a survey with 139 students and 11 semi-structured interviews. The work revealed that the blended learning condition better caters for students' engagement and learning as a result of the systematic use of the VM in course design, complementary use with a physical microscope, and the provision of tutors' support and guidance. We also found that the profile, previous experiences and influence perceived enjoyment and usefulness.