



Going digital in landform fieldwork: fad or opportunity and challenge?

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Although the use of digital outcrops may have become a routine way to collect and share geological information, this approach is less well used as a communication tool in geomorphology, whether to support students' understanding of landform processes or to engage the public in a scientific understanding of landscape features. This study sets out the use of 3D landform and outcrop models in virtual field trips (VFTs); initially developed as a COVID response when fieldwork was curtailed, but subsequently refined to support the Learning Outcomes of in-person fieldwork, as well as to promote Equity, Inclusion, Diversity (EDI) and Access in Environmental Education. On the basis of techniques developed for geoscience in Higher Education, digital visualisation tools (DVTs) have also been applied to reach out and facilitate the (virtual) accessibility of less accessible terrain.

Assessing the efficacy of the use of VFTs to augment the real-world experience of fieldwork in our Geography and Environmental Management degrees indicates that students are positive in engaging with these DVTs to support their learning. Moreover, VFTs can facilitate the inclusion of those unable to participate directly. 3D landform models are particularly useful in providing context and scale for VFTs but can be limited by surface distortion effects when some secondary sources are employed. Bespoke models, made through drone-based photogrammetry in particular, can significantly enhance the fieldwork experience. The additional perspectives they can provide, made available either alongside or directly in the field (i.e., on a mobile device) via interactive features, act effectively as an accessible 'remote' guide. Nevertheless, digital tools are seen as augmenting in-person field trips rather than as a replacement.

Given the recent enhanced interest in outdoor activities and the greater familiarity of much of society with digital devices, DVTs also offer a significant opportunity for public outreach with an Environment focus. Tegg's Nose Country Park (NW England) includes a RIGG (Regionally Important Geological and Geomorphological Site). Working collaboratively with the Park Ranger, the existing geological trail has been enhanced using DVTs to provide a VFT along the route and 3D models of the key outcrop and landform features. We aim to highlight the educational dimension of the Park's provision and better link the hub of the Park, where there are facilities, with the wider site which is less well used due to its layout and terrain. Engaging virtually provides potential visitors with a greater level of confidence and an enhanced awareness of the site's features, promoting positive engagement and behaviours.

Challenges in widening the use of DVTs lie in the provision of non-specialist interfaces and access to resources to facilitate their use by the widest range of Educators to promote inclusion and support outreach. Applications also need to remain mindful of the format that viewers will probably employ i.e., hand-held devices which may not have Internet access when really needed e.g., in the 'real' field.