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Immersive Virtual Reality for Geo-education: feedback from students, academics and the lay public

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Field-based classes in geological sciences are crucial components of geoscience education and research. Owing to the COVID-19 pandemic, such activities became problematic due to limitations such as travel restrictions and lockdown periods: this motivated the geoeducational community to tailor new ways to engage people in field activities. As a result, we adopted Immersive Virtual Reality as a tool to involve students, academics, and the lay public in field exploration, thus making geological exploration accessible also to people affected by permanent or temporary motor disabilities. In particular, we evaluated how users perceive the usefulness of this approach as applied to Earth Science learning and teaching, through nine outreach events, where a total of 459 participants were involved, with different ages and cultural backgrounds. The participants explored, in an immersive mode, four geological landscapes, defined as virtual geological environments, which have been reconstructed by cutting-edge, unmanned aerial system-based photogrammetry techniques. They include: Santorini (Greece), the North Volcanic Zone (Iceland), and Mt. Etna (Italy). After the exploration, each participant filled in an anonymous questionnaire. The results show that the majority would be willing to repeat the experience, and, most importantly, the majority of the students and Earth Science academics who took part in the navigation confirmed the usefulness of this technique for geo-education purposes. Our approach can be considered as a groundbreaking tool and an innovative democratic way to access

information and experiences, as well as to promote inclusivity and accessibility in geo-education, while reducing travel costs, saving time, and decreasing the carbon footprint. This work has been carried out in the framework of the following projects: *i)* ACPR15T4_ 00098 “Agreement between the University of Milan Bicocca and the Cometa Consortium for the experimentation of cutting-edge interactive technologies for the improvement of science teaching and dissemination” of Italian Ministry of Education, University and Research (ARGO3D - https://argo3d.unimib.it/); *ii)* Erasmus+ Key Action 2 2017-1-UK01-KA203- 036719 “3DTeLC – Bringing the 3D-world into the classroom: a new approach to Teaching, Learning and Communicating the science of geohazards in terrestrial and marine environments” (http://3dtelc.lmv.uca.fr/; https://www.3dtelc.com/); *iii)* 2018 EGU Public Engagement Grants (https://www.egu.eu/outreach/peg/).

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