THE PHOTOGRAMMETRY METHOD AND 3D VIRTUALIZATION TECHNOLOGY AS A LEARNING TOOL IN THE FLIPPED CLASSROOM AT COVID-19 TIME

A. Pérez-Ramos, M.D. Rodríguez-Ruíz, M.J. Bentabol

University of Malaga (SPAIN)
pera@uma.es, mdrodriguez@uma.es, bentabol@uma.es

From 2016-2017 academic year, the “flipped classroom” pedagogical methodology was launched in the Crystallography and Mineralogy subject to the first course of the Chemical degree in the University of Malaga (UMA). The change in the pedagogical methodology was carried out and, has continued at time, thanks to several Educational Innovation Project (PIE: 15/174; 17/116; 19/156), funded by the UMA. The application of the “flipped classroom” has increased the students’ participative, motivation, interest, responsibility and autonomy, as well as improvements in student learning (Lopes et al., 2019). Unfortunately, the covid-19 pandemic situation encouraged the search to new tools or software to allow students to be able to carry out the practical classes about the stereographic projection of wooden crystallographic models (in three-dimensional, 3D) at home, not in person.
The aim of this contribution has been the virtualization of the wood crystallographic models (3D) collection so that students could access them at home and carry out the practices of Crystallography and Mineralogy subject. For this purpose, a non-invasive, easy and cheap method was used, photogrammetry (Mallison and Wings 2014; Pérez-Ramos et al. 2014).The photogrammetry consists in obtained 3D model surface of an real object from many two-dimensional (2D) photographs acquired from different points of views (Mallison and Wings 2014; Pérez-Ramos et al. 2014). Finally, the 3D virtual models obtained by photogrammetry technique and different virtualization software are being used on-site practices classes and provide the opportunity to the students to continue practicing in the stereographic projection from the 3D model of crystalline solids at home. Moreover, these interactive pdfs serve as material that can be evaluated by teacher, since they contain internal tools that enable the pdf to be able to make measurements, rotations, movements, etc, on the 3D virtual reconstruction, giving students an experience of physical reality.
In this study, the precision of the photogrammetry method has been calibrated and validated through the use of other higher precision techniques such as high resolution CT scan (microCT) and surface laser scanner. The crystallographic objects have been obtained with a precision and detail that are within what is acceptable both for use in scientific research and for educational use for students.

Keywords: Photogrammetry, virtualization, 3D models, teaching collections, crystallography, educational innovation projects, interactive practices.