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Using 3D Printers to Model Earth Surface Topography for Increased Student Understanding and Retention

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In February 2000, the Space Shuttle Endeavour flew a specially modified radar system during an 11-day mission. The purpose of the multinational Shuttle Radar Topography Mission (SRTM) was to "obtain elevation data on a near-global scale to generate the most complete high-resolution digital topographic database of Earth" by using radar interferometry. The data and resulting products are now publicly available for download and give a view of the landscape removed of vegetation, buildings, and other structures. This new view of the Earth's topography allows us to see previously unmapped or poorly mapped regions of the Earth as well as providing a level of detail that was previously unknown using traditional topographic mapping techniques.

Understanding and appreciating the geographic terrain is a complex but necessary requirement for middle school aged (11-14yo) students. Abstract in nature, topographic maps and other 2D renderings of the Earth's surface and features do not address the inherent spatial challenges of a concrete-learner and traditional methods of teaching can at times exacerbate the problem. Technological solutions such as 3D-imaging in programs like Google Earth are effective but lack the tactile realness that can make a large difference in learning comprehension and retention for these young students.

First developed in the 1980's, 3D printers were not commercial reality until recently and the rapid rise in interest has driven down the cost. With the advent of sub US$1500 3D printers, this technology has moved out of the high-end marketplace and into the local office supply store. Schools across the US and elsewhere in the world are adding 3D printers to their technological workspaces and students have begun rapid-prototyping and manufacturing a variety of projects.

This project attempted to streamline the process of transforming SRTM data from a GeoTIFF format by way of Python code. The resulting data was then inputted into a CAD-based program for visualization and exporting as a .stl file for 3D printing. A proposal for improving the method and making it more accessible to middle school aged students is provided. Using the SRTM data to print a hand-held visual representation of a portion of the Earth's surface would utilize existing technology in the school and alter how topography can be taught in the classroom. Combining methods of 2D paper representations, on-screen 3D visualizations, and 3D hand-held models, give students the opportunity to truly grasp and retain the information being provided.