An Alternative to Wretched Visuals for Visual Learners!!

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The three-dimensional structure of many minerals and molecules is crucial to the function and behavior of those minerals and molecules, and therefore the problem of molecular visualization runs through many of the natural sciences, from the microscopic to the macroscopic. The standard two-dimensional illustration of those minerals and molecules is often of relatively poor quality and one can legitimately wonder whether students are really learning from those textbook illustrations. The advent of molecular visualization software on desktop computers has opened up new vistas in educational material, but it remains to be seen if students really learn more or better. Furthermore, the new frontier of molecular visualization is stereoscopic 3D, in which right eye and left eye receive slightly different angles of view of the same object, blending in the brain into a true 3D image, and it too is untested as to its educational value—is it worth the trouble?

My project proposes to construct a standard lesson on layer silicate 'construction', using ball-and-stick and polyhedral representation of the fundamental structural units. The standard lesson will be cast in 'flat' form, i.e., 2D and non-interactive; 2½-D, with perspective, shading, and the other standard depth cues, with and without user interactivity; and stereoscopic 3D view, interactive. Student subjects will be first tested for spatial reasoning skills using a standard test, then move through the standard lesson in one or another of its variations, and then be tested for comprehension of the lesson by being given tasks in object assembly. It is expected that depending on initial spatial skills, students will respond differently to the dimensionality of the lesson; it is hypothesized that students with the best spatial skills will learn better from 2D illustrations than those less agile and that all will learn better from 2½-D than 2D.

At this point in the project, a portion of the standard lesson on layer silicates has been constructed and presented to a class of students for informal feedback, toward the goal of making a more refined lesson. The polyhedral model set for use in testing object assembly skills has been chosen and modified to meet needs. The development of stereoscopic 3D viewing facilities remains problematic.

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WTS 06-07