Faculty at Work

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UCCS faculty creating a culture of innovation in teaching

Imagine a classroom where:

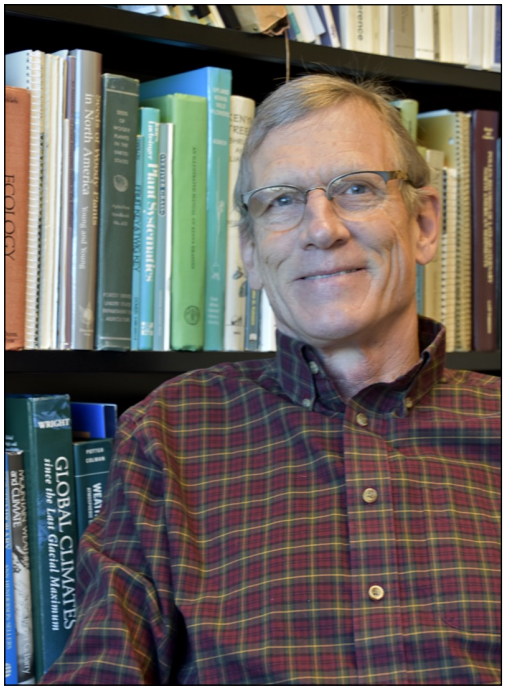
- *A blind student can study the contours of any geographic terrain*
- *An architecture student creates a 3D model of a building that she has been drawing*
- *Engineering students explore concepts in 3D and print out prototypes*

Steven Jennings, PhD, Associate Professor
Geography and Environmental Studies Department

Pairing a lecture with a tactile representation including math manipulatives, science labs, or geographic images creates opportunities for students who have visual impairments or have difficulty pairing 2D images with 3D models.

Dr. Jennings has taught GES 1010 Environmental Systems: Landforms many times, but spring 2016 was the first time he had a blind student in his class. Working with Leyna Bencomo, Assistive Technology Specialist, he created 3D images of the Earth's surfaces as well as thermal/raised diagrams to accommodate the blind student. Dr. Jennings found that all of the students benefitted from the use of 3D models.

Read the complete interview with Dr. Jennings.



Imagine a classroom where:

- A blind student can study the contours and terrain of any area
- An architecture student creates a 3D model of a building that she has been drawing
- Engineering students explore concepts in 3D and print out prototypes

Pairing your lecture with a tactile representation of math manipulative, science labs, or geographic images can create opportunities for students who have visual impairments or have difficulty pairing 2D representations of 3D images. Dr. Steven Jennings, Associate Professor, Geography and Environmental Studies Department, has taught GES 1010 Environmental Systems: Landforms before, but the spring 2016 was his first time he had a blind student in his class. Working with Leyna Bencomo, Assistive Technology Specialist associated with the Disability Services Office, he created 3D images of the Earth's surfaces as well as using thermal/raised diagrams. Dr. Jennings found that his blind student was not the only student who benefited from these 3D models.

1. What 2D images do you print 3D for students with visual impairments and how does it make learning accessible?

In Geography, information graphics such as maps and diagrams are an integral part of student learning. There are many 2D ways of representing the Earth's surface, like maps and block diagrams but a vision-impaired student accessing graphical information is problematic. It is virtually impossible for a visually impaired student to understand landforms without a 3D presentation of the material. In my landforms class, I use 2D images to represent the concepts. To make them accessible, I converted 2D representation into 3D landform models. The student explored the contours with his hands instead of having to visualize it while I explain it.

2. How did your blind student enrich your classroom in terms of the way you chose to present your material, your methods of engaging students and the way they express their knowledge of the material?

Tactile images are helpful for blind students as well as students with partial vision such as glaucoma or cataract. As a corollary, I realized that sighted students could also benefit from the 3D landform models. Generally, I assumed that students are able to take a topographic map and in their mind convert the map into a mental image of the 3D surface. This is not the case, some students are not able to make that conversion and it makes sense to make the 3D models available to all students. Some students learn better using a tactile model than a visual model. They learn best through hands-on experiences.

In Geography courses, students are required to visualize the contours of topographic maps as 3D surfaces. In my class, it is not always convenient to helicopter over a canyon for students to experience the contours. The absence of actually fieldwork in the classroom setting poses challenges for students who have difficulty conceptualizing topo maps. Minimizing terrain into a smaller but still 3-dimensional experience can still enrich my students' understanding. By having the ability to touch the texture of a surface, students are able to conceptualize, digest, and understand the concepts they are being taught. I now have several examples of landforms that I can use in the class in the future.

3. What are some of the greatest challenges you have experienced in the process of using 3D printing for students?

It took me several hours to learn what to do, but now I can create the file for the 3D printer in less than a half hour. The method I use involves using four software programs. Each step converts the file into a different format used by the next program. This requires a fair amount of organization and vision of the final project. Another method uses Google Maps. The drawback of this method is that resolution of the data is more coarse, so the 3D model is not as detailed.

4. How do you see 3D printing potentially fitting into higher education in providing accessible materials to all students?

3D printing is transforming the classroom experience. A 3D printer scans and then “prints” objects layer by layer until forming the desired 3D object. 3D models turn abstract concepts into something concrete. Faculty can use 3-dimensional visual aids to illustrate concepts instead of just pictorial representations of objects. Furthermore, it enhances hands-on learning allowing students to produce realistic 3-D models. If you are interested in how you can integrate it into your own course, contact Steve Jennings, sjenning@uccs.edu