The role of professor involves balancing teaching, research, and service. Few institutions today can afford to give tenure based solely on research whilst ignoring poor teaching. Outreach to parents and the community is increasingly important as expensive research universities and 4-year colleges seek to demonstrate their relevance in the age of much less expensive community colleges and distance education. Nevertheless, some faculty complain that teaching and outreach compete for their coveted research time.

Some fields of research have such broad impacts that they merit the dedicated time of our best scientists. However, other research projects constitute little more than publicly funded professorial hobbies. The challenge is to reliably prioritize the research questions meriting investigation.

In ODU’s geospatial visualization group, Ph.D. theses must include at least one chapter on development and testing of teaching materials. TAs teach throughout their graduate years, testing visualizations in class (they also do ‘pure’ geospatial research to justify a degree in science rather than science education). They also give public outreach planetarium shows on a wide range of geoscience and planetary science topics. Thus they tackle the three aspects of academic work from the outset of their PhD studies.

In contrast, students in other programs frequently serve as TAs only in their first year, then switch to grant-supported RA work, resulting in a steady stream of new inexperienced TAs in need of basic training.

[Image: Photo and 'research hobby' by the author]

©2012 Google Inc. Images courtesy NASA
Model by Whitney Brooks

©2012 Google Inc. Images courtesy NASA
Model by Miladin Dordevic

Our policy has led to the emergence of a paradigm for academic inquiry:

We develop and test visualizations to cover the gamut of Earth & Planetary Sciences. If these resources fail to achieve desired outcomes, we look into their design but also examine our own understanding of topics, since instructor misconceptions are an obvious hindrance to learning.

Redesign of visualizations may improve outcomes, but sometimes the problem lies not with presentation or content knowledge, but rather with gaps in the science itself. Thus teaching and public outreach can become vehicles for the discovery of fertile research questions.
Example 1: After the Hawaiian Kiholo Bay earthquake in 2006, Nathan Williams and the author decided to create a Google Earth damage tour with news photos, a draped USGS shake map and models of historic first motion data.

To help students understand nodal planes, we added colored planes to classical geophysical "beach balls." This lead to the realization that the orientation of some nodal planes was linked to the locations of neighboring events and to a model of a shallow landward dipping, corrugated slip surface.

Example 2: After the American Samoa tsunamigenic earthquake of 2009, Steve Wild, Mladen Dordevic, and the author created emergent block models on Google Earth to illustrate the tectonic setting.

Creating animated models for multiple working hypotheses to explain the flat slab at depth in the Tonga subduction system lead to a new hypothesis of rapid rollback and slab foundering that had not been considered previously in the research literature. Thus the creation of teaching resources helped shine a spotlight on a research question.

Example 3: A new model aimed at explaining the Hawaiian Islands dog-leg is currently leading to research by Mladen Dordevic into the relationship between the shape of the island chain on the surface and the shape of the mantle plume at depth.

Take-home Thought: A policy that establishes teaching and service as bridges leading to research products has the potential to generate transformative changes in the education that graduate students deliver and thus the education that undergraduate students receive.