3-D Printing
Not Just a Makerspace

Craig Amos
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3-D Printing vs. Digital

- Rapid, colorful, real, and coming to a library near you!
- Affordable
- Versatile
- Tactile
- Fun!
University of Texas at Dallas: 3-D Modeling as Visual Aid for Learning Multivariable Calculus Students (UT Dallas, 2017)

Literally Grasping a Concept

The 3-D models help many students clear a significant, early hurdle to grasping the math behind the shape.

"I found the model's useful when talking about limits and absolute maximums and minimums," said Archit Singh, a junior studying molecular biology. "With limits, having 3-D meshes greatly helps visualize the paths that must all lead to the same point. With max and min, a 3-D model allows an easy look at the corners and edges where they may exist."

Using the models, the active learning sessions help students mature in the subject by forcing them to explain things to each other, Zweck said.

"They start to learn to think in the subject, to solve problems that require creativity, merging concepts together," he said. "Students can often write it on the board, but can't explain it — no one's ever asked them to. I'm asking them to explain to each other what they're doing. If you can explain math to somebody, you can explain anything technical."

These skills apply to a wide subject area, and to many eventual fields of study and work.
Software to Solid

Texas A&M University
Combining Maple with 3-D Printing to Teach Mathematics (Maplesoft, n.d.)

User Case Study: Making math tangible with Maple and 3-D printers

Building goblets with Maple helps students learn Calculus 2 concepts

Maple has long been used in the classroom to help students learn mathematics through visualizations, real-world applications, interactive explorations, and other techniques that make mathematics more concrete for the students. Now, with the advent of 3-D printing, instructors have another means of making mathematics more tangible to their students. And this time, "tangible" is meant literally.

Dr. Philip Yasskin, professor of mathematics at Texas A&M University, has started combining Maple with 3-D printing to teach his students about solids of revolution. His Honors Calculus 2 class recently completed a project in which they designed goblets as solids of revolution, and then actually constructed the goblet so they could see, and touch, the results.

Students were asked to design a drinking glass or vase as a solid of revolution satisfying certain restrictions on the liquid capacity, volume of glass, thickness, and location of the center of mass. The students used Maple and the integration techniques they learned in Calculus 2 to define the mathematical expression whose volume of revolution met the requirements. They then graphed both the 2-D curve and the 3-D volume of revolution using Maple's extensive plotting facilities. Once they were satisfied with both the mathematics and aesthetics of their solutions, they exported the 3-D graph from Maple into a file format understood by the 3-D printer, and printed out their object.
Tools for Research and Learning

John Reynolds, Emerging Technologies Librarian, NSU Health Professions Division Library, Nova Southeastern University
Printing Models for Reserve

Circa 1960
(roughly 8"

NSU Health Professions Division
Library Finished Product
Printing Models from Scans

*Courtesy of NSU Health Professions Division Library*
Recommended Sources for Printable Files from NSU Health Professions Division Library

NIH 3-D Print Exchange: www.3dprint.nih.gov

BodyParts3D/Anatomography: http://lifesciencedb.jp/bp3d/?lng=en

Thingiverse: www.thingiverse.com

Sketchfab: www.sketchfab.com

*Courtesy of NSU Health Professions Division Library
Zinc Finger Folding Activity, MSOE Center for BioMolecular Modeling (Walter Schroder Library, n.d.)
NSU Halmos College Students and Faculty Join Center for BioMolecular Modeling to Present Research at National Conference (Nova Southeastern University, 2017)
Questions?

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