1035-97-38 **Daniel Lee McGee*** (mcgeedan@gmail.com), P.O. Box 9018, Mayaguez, PR 00681-9018, and **Deborah Moore-Russo**, **David Lomen**, **Dennis Ebersole** and **Maider Marin Quintero**.

Physical Manipulatives for Visualizing Multivariable Concepts and How They Can Reform Mathematics Courses such as Basic Algebra, Precalculus and Calculus.

Computers are invaluable for visualizing concepts in 3D. However, there are many concepts where the 2D nature of a computer screen can limit their effectiveness. E.g., directional derivatives require the projection of a normal to a surface in a specified direction. In 3D, a surface can be placed over the xy plane, the direction on the xy plane can be indicated and the concept can be visualized quite easily. However, working with a precise direction and its associated tangent line on a 2D computer screen requires that students visualize and reason about a 3D situation in a virtual 2D environment. A more effective pedagogical approach is the use of physical 3D manipulatives. 3D manipulatives also allow us to present multivariable concepts much earlier. Visually presenting precalculus concepts, such as the definition of a function, in both 2D and 3D improves student comprehension. In this presentation, a consortium of universities (NSF-DUE-0442365) will provide an overview of the physical manipulatives being created, some of the basic algebra, precalculus and multivariable calculus materials that accompany them, some preliminary results on their effectiveness and a summary of how these tools provide a new direction for the reform movement in math education. (Received June 10, 2007)