Understanding Platonic Solids: Turning a Polygon into a 3 Dimensional Object

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Abstract

My teachers had a difficult time teaching me how to find the surface area of a 3-D object, especially when I was looking at a 2-dimensional diagram. My goal is to teach people the concept of area and volume of a platonic solid through the use of 3-D pull up nets. A platonic solid is a regular, convex polyhedron. It is constructed by congruent, regular, polygonal faces with the same number of faces meeting at each vertex. Five solids meet these criteria: a tetrahedron, cube, octahedron, dodecahedron, or icosahedron. In 1994, mathematics educator Bob Vertes introduced E.B. Meenan to the idea of Pull-up polyhedron nets. These nets could be created using only a card and string and easily folded up into a beautiful, three-dimensional shape. Applications: Learning about volume and area through the use of platonic solids facilitates understanding and therefore easier for a person to apply these concepts in life. Using Pull-up nets is helpful to students who are visual or hands-on learners. Platonic solids are the basis for engineering, architecture, and geometry. Pull-nets can be used in many areas of life. Pull-up nets can form the basic design element of multiple objects from tents and bowls to prosthetic limbs. I want to advance the use of pull-up nets for tent-design, and as the basis for prosthetic limb design. One other interesting questions I will explore include: 1. Is there only one pull-up net for each Platonic solid. A good starting point to explore this question is to consider the eleven distinct nets of a cube. I will explore if each of these formations form a string based Pull-up net. 2. What about other nets for other shapes like a tetrahedron (triangular pyramid)? 3. What about other polyhedra, do they have pull-up nets? My research based on the work of Bob Vertes, EB Meenan and BG Thomas makes understanding volume and surface area of a 3 dimensional object fun and easy. References [1] E.B. Meenan. "Be a Paper Mathemagician", from Motivate: Videoconferences for Schools [online]. [Accessed 15/01/2008.] Available from World Wide Web: [2] B.G. Thomas. Form, Shape and Space: An Exhibition of Tilings and Polyhedra. The University of Leeds International Textiles Archive, UK. 10 October 2007 - 16 May 2008. [3] P. D. Turney. "Unfolding the Tesseract", Journal of Recreational Mathematics 17, no.1, pp.1-16, 1984-85. [4] B.G. Thomas and M.A. Hann. "Patterned Polyhedra: Tiling the Platonic Solids" in R. Sarhangi and J. Barrallo (eds.) Bridges Donostia: Mathematical Connections in Art, Music, and Science, pp.195-202, 2007. [5] B.G. Thomas and M.A. Hann. Patterns in the Plane and Beyond: Symmetry in Two and Three Dimensions. Monograph no. 37 in the Ars Textrina series, The University of Leeds International Textiles Archive (ULITA). 2007. [6] Pull-up Patterned Polyhedra: Platonic Solids for the Classroom E.B. Meenan* and B.G. Thomas School of Education* and School of Design University of Leeds Leeds, LS2 9JT

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