Math Connections to Earth and Space Science

Glen Schuster

Endeavour

Math Fair 1998/1999

Mr. Maccia Mr. Oliveira Mr. Colarusso

Math in Motion

The theme "Math in Motion" brought to mind one of the Seven Wonders of the World, The Pyramids of Giza. The process used to build the pyramids without advanced math and motor skills fascinated us. Motion was a necessary part of the construction of the pyramids. Using information from the Internet site http://www.pbs.org/wgbh/nova/pyramid/explore/builders.html **Who Built the Pyramids,** we researched how they were constructed.

The blocks, constructed in a quarry, were moved along different ramps, which were made of Talfa, clay that becomes slippery when wet. Because the ramps were wet, there would be less friction and the men could move the blocks easier and faster. Using levers and pivots, the blocks were moved along the ramps.

We used the actual dimensions of the Pyramids of Giza to create our scaled model, finding information at this site: http://www.sover.net/-re/deep secrets/index.html **The Great Pyramid, The Golden Ratio, and The Royal Cubit.** The height of the Pyramid of Khufu was 455 feet high, the width and length 755 feet. The pyramids were made up of blocks, at 5 feet high, 5 feet long, and 6 feet wide. Each side contained 151 blocks and the angles were equal to 51 degrees.

Using this background information, we worked out the scale. We started with 1 inch equal to 5 feet but realized that our project would be too large. When we tried to scale it to ½ inch equal to 5 feet, the calculations for the depth, 6 feet, didn't work out correctly. Instead we tried making each block equal to 6 original blocks. Each pyramid will use 24 blocks, cut in different sizes.

Building this model has shown us the magnitude of work that went into the construction thousands of years ago. The Pyramids of Giza are truly a wonder of the ancient world.

The Dilemma

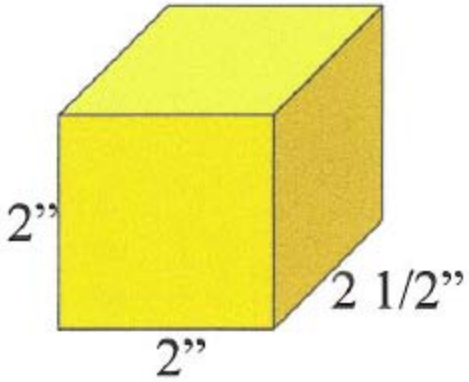
Modern man has an abundance of technological resources at its disposal. However, the ancient Egyptians did not have this advantage. Miraculously, they managed to construct vast pyramids. The way the Egyptians got the huge blocks from the quarry, to the Nile, to Giza, to actually building the pyramid is...

MATH IN MOTION!

The Beginning-Building the Pyramid Blocks

An actual photo of the blocks used in the building of the pyramids (5' x 5' x 6').

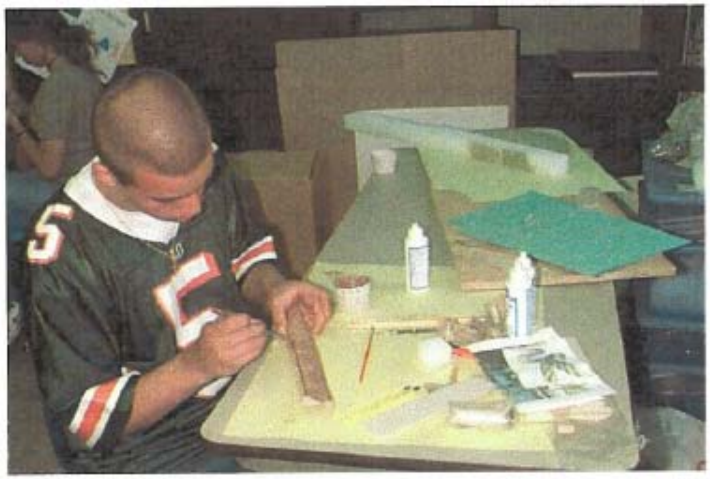
This is our scaled-down model of the block shown above. The dimensions for the model are: 2" x 2" x 2 1/2"



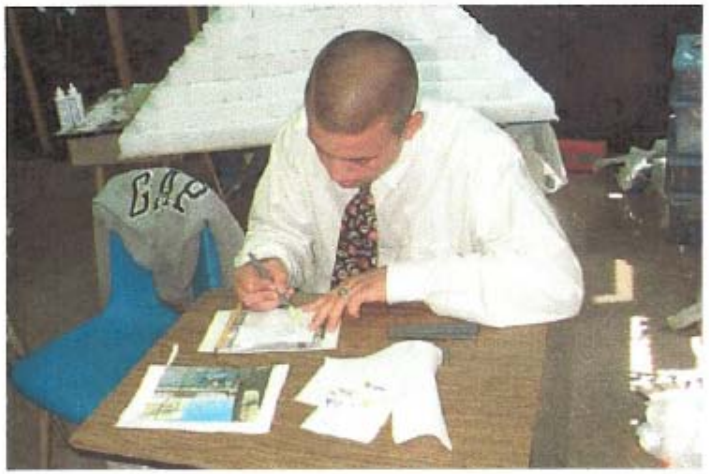
Transporting the Blocks

A painted replica of the boat used to transport the pyramid blocks to Giza

Our model of the boat shown above

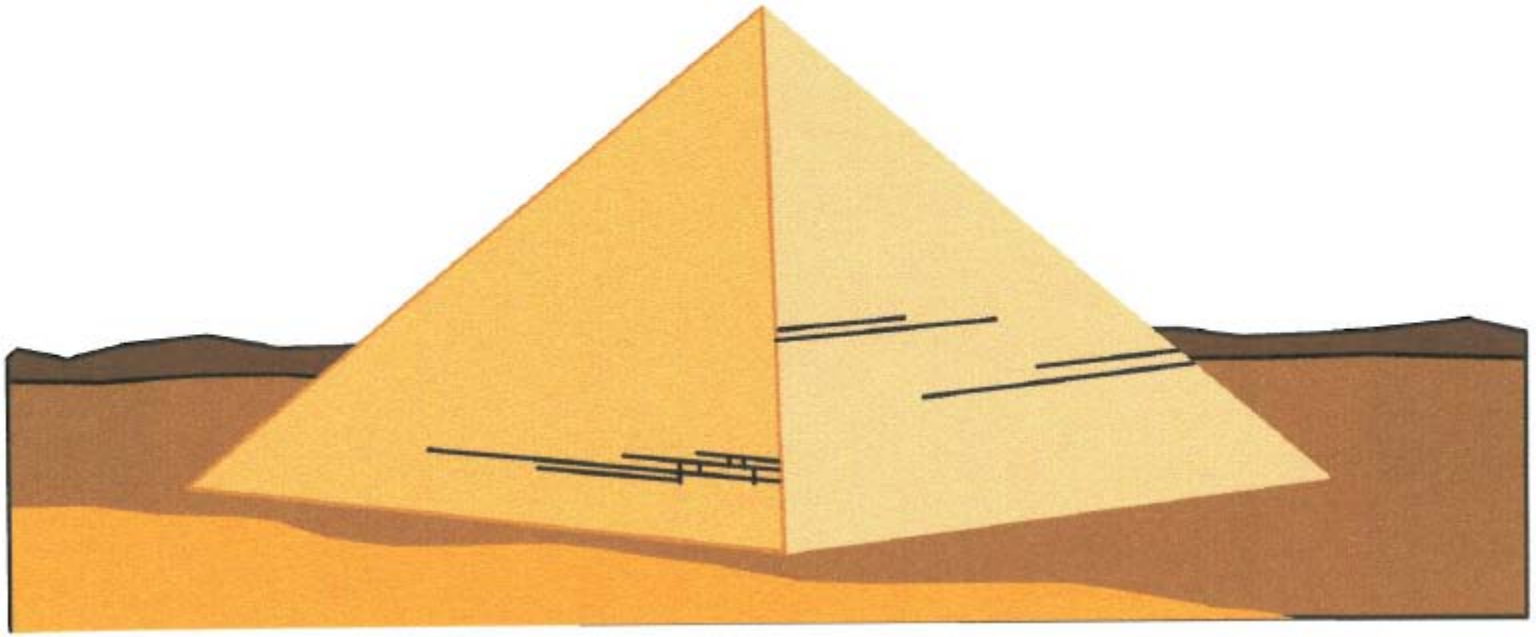


Claudio is shown here constructing the boat in which the actual pyramid blocks were transported.



This is a full-scaled model of the boat.

Constructing the Base of the Pyramid

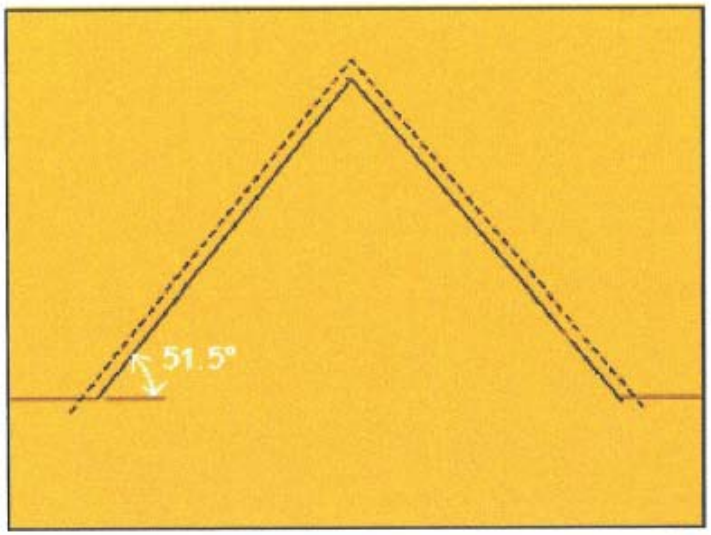


Julio Da Silva cuts out the blocks from the big Styrofoam slab.

Amanda Soares positions the blocks to fit the border of the pyramid template and the board edge.

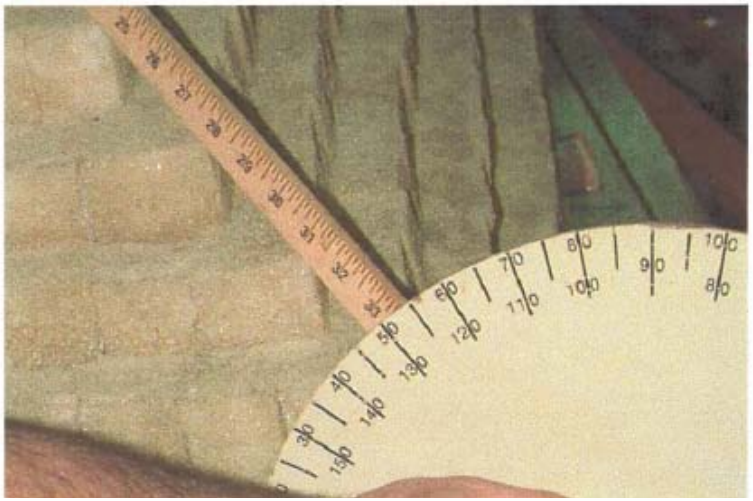
In these shots, the group members stack the blocks alongside the pyramid template.

Julio and Joseph apply sand to finish the pyramid.

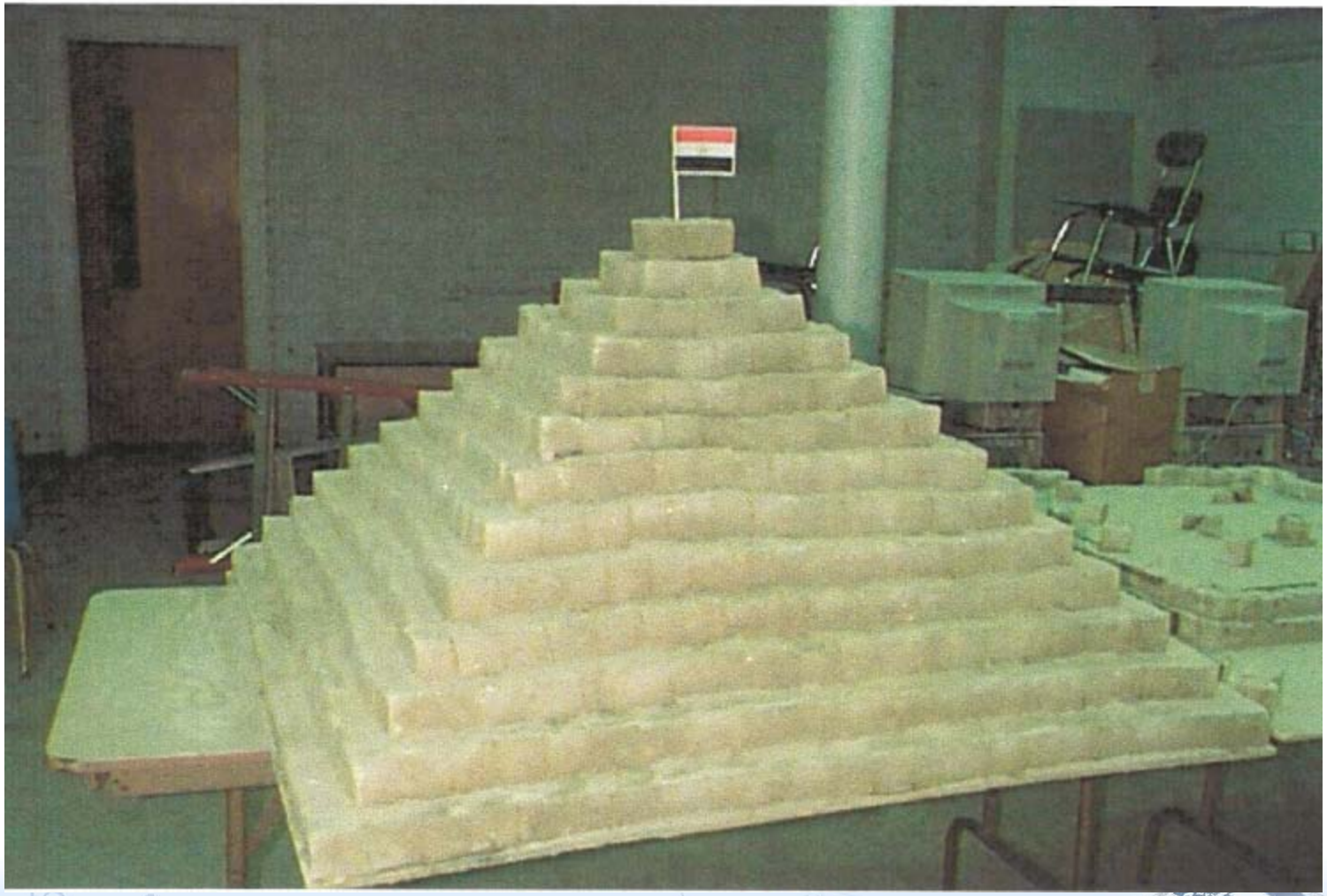


Each side of the Pyramid of Khufu rises at an angle of 51.5 degrees to the top.

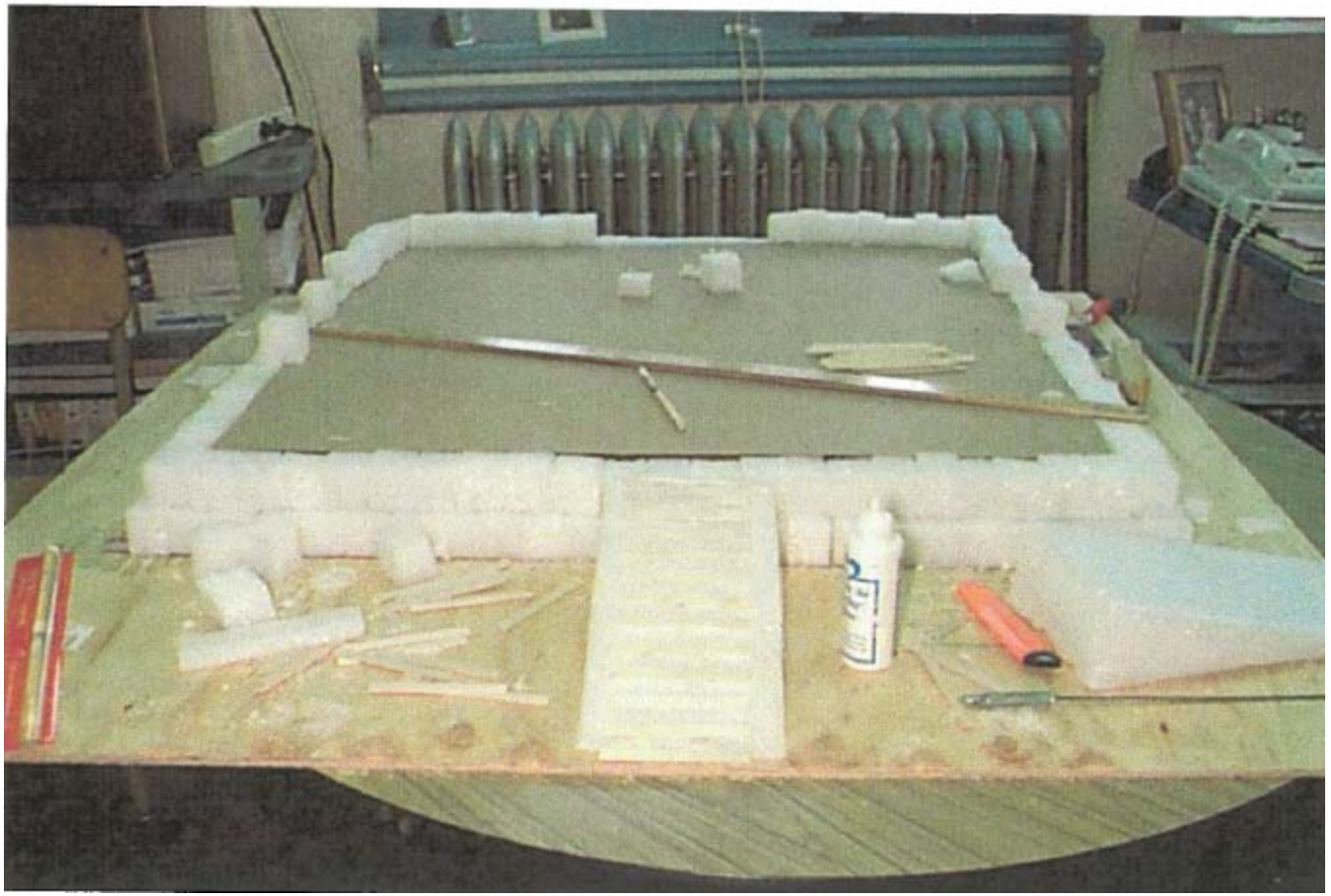
Our model of the Pyramid of Khufu is approximately 55 degrees.

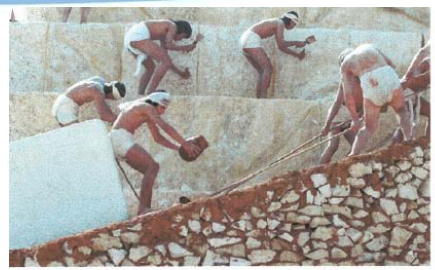


The Great Pyramid of Khufu



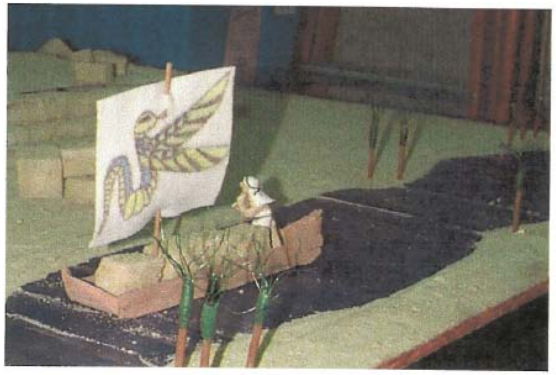
Additional Pyramid Features





This picture shows a reenactment of men building the pyramids.

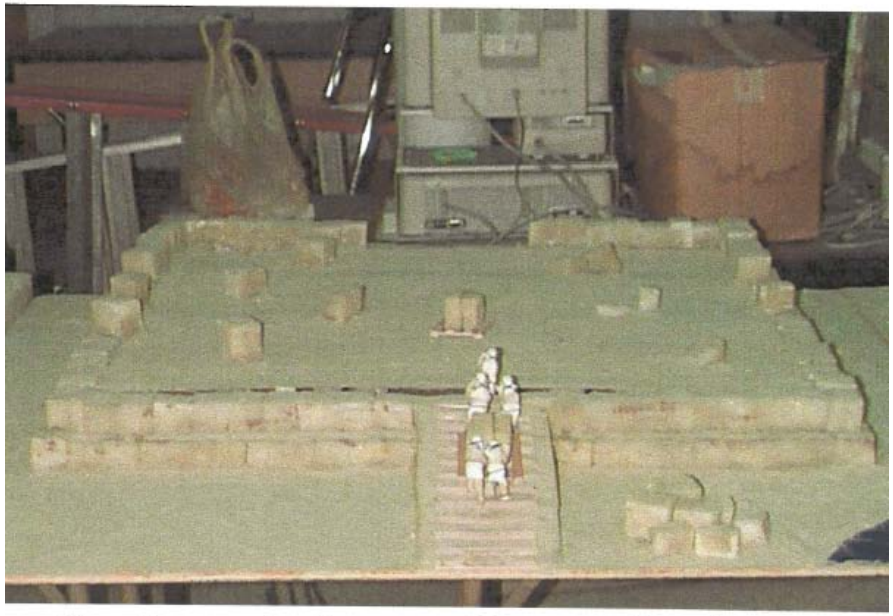
Inddy creates tiny model men out of clay to simulate constructing the pyramids.



The ancient Egyptians used the currents from the Nile, the wind force, and physical strength of men to navigate and transport the blocks from the quarry to the construction site.

The angles of the ramps had to be precise enough to allow the men to drag the blocks up to the construction area. Also, the wooden sled and ramp were wet to reduce friction.

The Pyramid of Khafre



One theory: As the pyramid grew taller, the ramp had to be extended in length, and its base was widened, or else it would collapse.

The Pyramid of Menkaure

Another theory was that the ramps could have run from one step to another rather than approaching the pyramid face at right angles.

The on start of this Math Fair Project began with the theme "Math in Motion", and as a team we decided to go cross curriculum in order to have a more detailed project.

Math: Incorporated units on Proportions and Ratios, Scaling, and Geometric Shapes. As well as the basic fundamentals of math.

Science: Incorporated unit on Force and Motion which deals with mass, inertia, gravity, density, volume, weight, friction, and use of simple machines.

Literacy: Involved many strategies for reading such as: predicting, clarifying, connecting, questioning, and evaluating information that was researched. Also writing, revising, and editing the main essay.

Social Studies: Topic of interest was one of the Seven Wonders of the World, the Pyramids of Giza.

Art: Created models using various techniques: clay sculpting for people, wood crafting for boats, painting for boat's sail, metal and wood shaping for trees, and scale modeling of pyramids.

Music: Researched and recorded Ancient Egyptian Music

Technology: Created presentation using multiple methods: internet for research, digital camera for photographing students work, Power Point presentation for slide show on laptop, and recorded and transferred music onto laptop Power Point presentation

The Winner Is…..