Low-cost Science

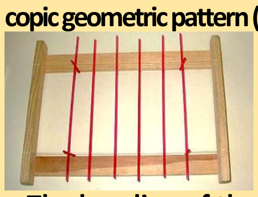
SCIENCE ON STAGE 2017 DEBRECEN

THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

MORE THAN MATHEMATICS

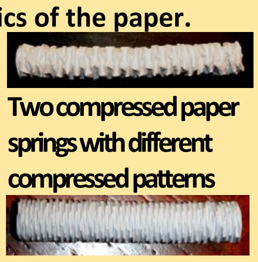
Entertaining and modern methods to teach mathematics

The physical forces and other interactions (physical, chemical, biological) create geometric patterns. The physical and other characteristics of materials depend on the macroscopic and microscopic geometric pattern (and inner structure) of that material.



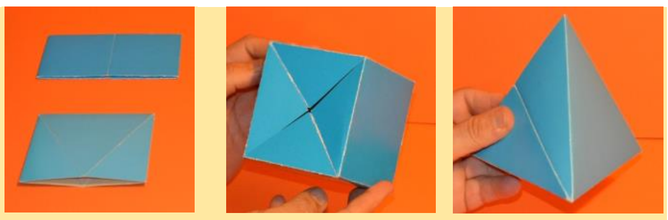
The pattern of the electrically charged straws (suction strains) is determined by the force effects acting on them.

The bending of the paper strips and the pattern and properties of the paper spring (made from paper roll) depend on the geometric structure of the cellulose threads arranged in the fabrics of the paper.

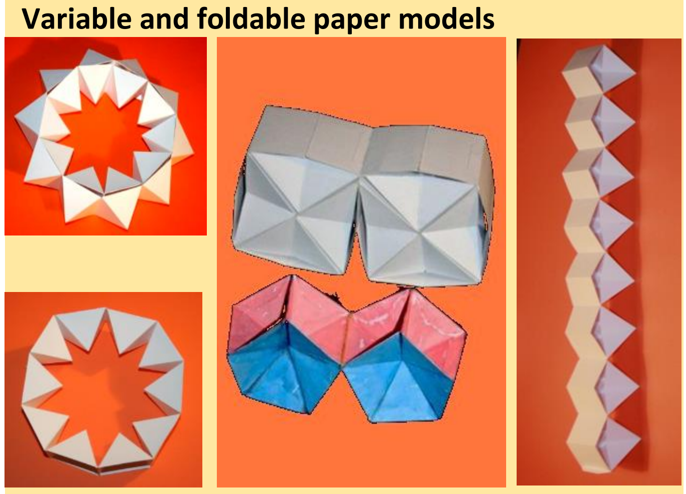


Two compressed paper springs with different compressed patterns

The unparalleled beauties of the world have been produced by the physical, chemical, biological and human interactions.

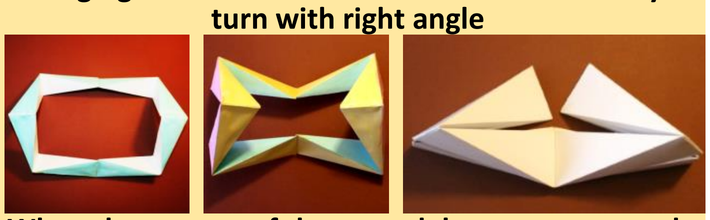


Variable and foldable paper models



The chain of tetrahedra ... ... solidified in spiral forms ... One variation

Changing the direction of tractrix of the forces by a turn with right angle



When the centers of these models are compressed, the two ends of the models approache each other: this motion is perpendicular to the direction of the initial compression

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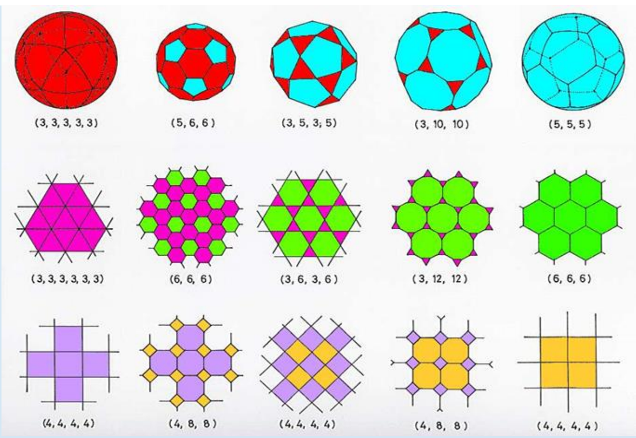
"I hear it and forget; I see it and believe; I do it and understand." (Confucius.)

For 40 years we have been trying to bring the mathematics to the world of impressions and enthusiasm of students. We did this by making our home-made, varied, variable tools which give playfull learning and experience gaining. We also teach students and young people to make such tools. We stopped the traditional visualization of mathematics which used statical, boring, and rigid illustrations. Our tools and devices are variable, interactive and focus on touch them and concentrate on the coordination of morions. Most of them can be easily folded in small folds and this way they can be transported. The fact that these models can be formed into an almost infinite number of variations arouse the interest of students. Variability also helps discovery of the internal contexts in structures.

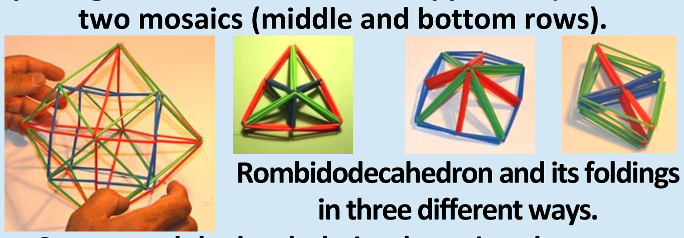
For the sake of effecticity of our work, we do not limit a rigid boundary between mathematics and science education, but we point to mutual relationships. An example is that the structure of the material is shaped by the interactions between its particles and on the other hand, the material properties are strongly dependent on the geometry that is formed.

When producing spectacular color tools we also show the relationship between arts and mathematics and physical interactions, as well.

We pay particular attention to the fact that mathematical and the scientific knowledge is inseparably linked to each other and to the everyday life. This mutual connection requests that the education of mathematics and science should be linked.



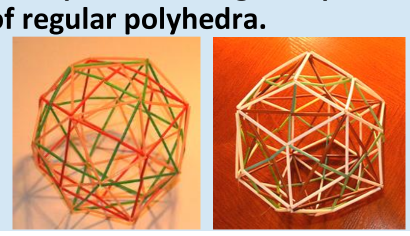
A simple truncation line for bodies (icosahedron-pentagon-dodecahedron line, upper row), and for two mosaics (middle and bottom rows).

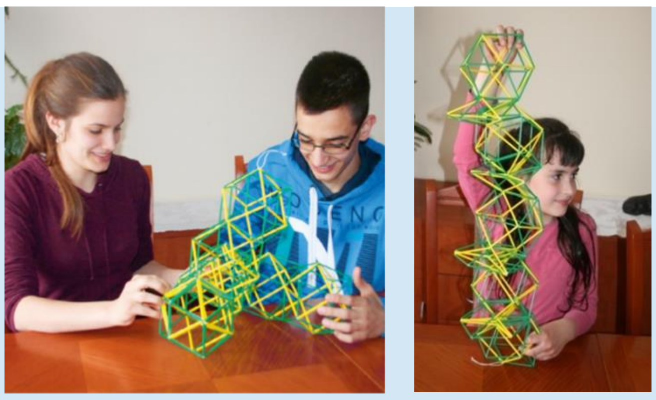


Rombidodecahedron and its foldings in three different ways.

Straw models that help in observing the space duality of regular polyhedra.

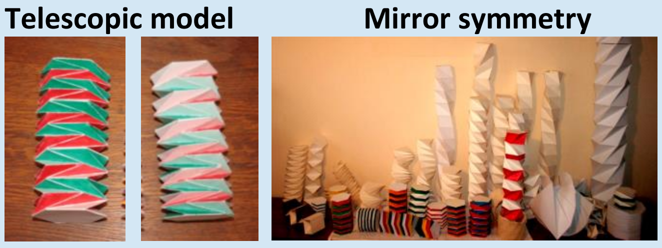
The deltoid 24 and the skeleton of the polyhedron bordered by 48 rhombi faces





What a good game is mathematics!

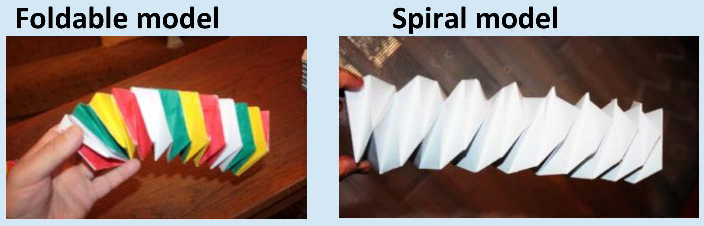
Telescopic model Mirror symmetry



Polychromic models A group of foldable geometric models

Helical shapes topologically homeomorph with the cylinder surface. Thier predefined pattern determines the properties of the helical cylindrical structures. The number of possibilities is, in principle, infinite. We made foldable models for those cases which can be folded into the plane and which have limited space demand, because the design is time-consuming and requests accurate editing.

Foldable model Spiral model



They are all different: One is felxible, the other is not.