

sub patronajul
Academiei de Științe Tehnice
din România

3DMind

Program de educație și stimulare
a Inteligenței Spațiale

Pregătim copiii pentru profesiunile secolului 21

Program educational pentru dezvoltarea inteligentie spatiale De la modelare 3D la 3D Printing

Luigi Damian - presedinte EDU 21

“If you want to teach people a new way of thinking, don't bother trying to teach them. Instead, give them a tool, the use of which will lead to new ways of thinking.”

Buckminster Fuller

Importanta inteligentei spatiale in educatie
Structura programului 3D Mind
Rezultate & Avantaje
Concluzii

Importanta inteligentei spatiale

Ce este IS

CONCEPTE referitoare la spatiu

PROCESE de gandire pentru intelegerea relatiilor din si intre structurile spatiale

INSTRUMENTE DE COMUNICARE despre aceste structuri si despre relatiile dintre ele sau dintre acestea si spatiul inconjurator

Daca nu identificam la timp IS

Experiment Lewis Terman

Cateva mii de copii - teste IQ

William Shockley si Luis

Alvarez nu ating scorul 135.

Ulterior, aceastia ajung doctori in stiinte si iau Premiul Nobel

Cati astfel de copii se pot pierde pe parcursul proceselor educationale clasice?

Competente STEAM si IS

DOMENIILE STEAM

Principal motor al dezvoltarii globale

Artele, designul, arhitectura, medicina, nu mai pot face abstractie de inteligenta spatiala.

Cate programe educationale pentru dezvoltarea Inteligentei Spatiale va sunt cunoscute?

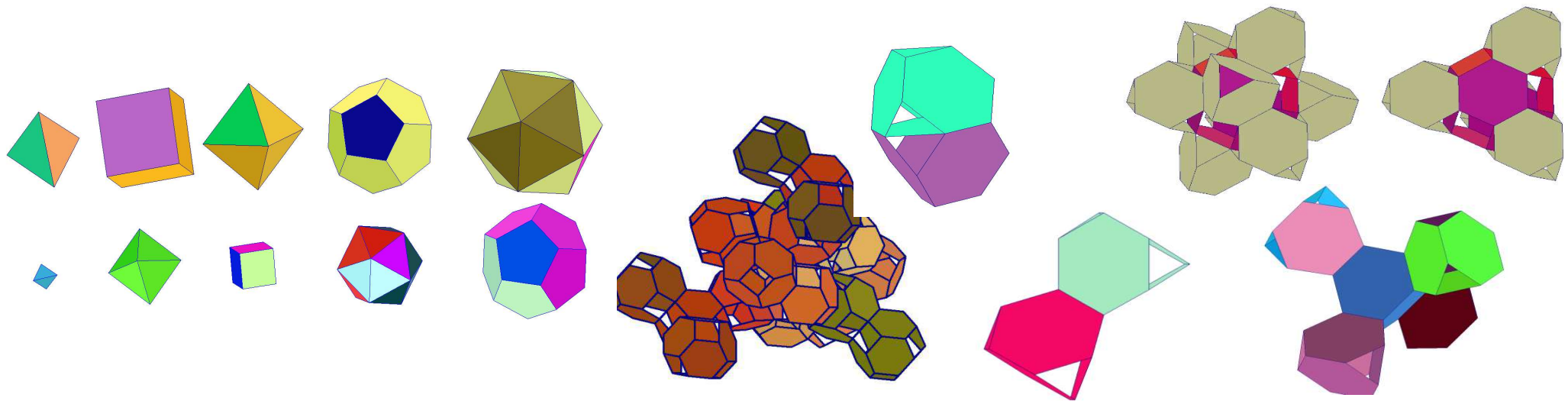
Structura

XColony Game Systems

O serie de transformari metamorfozeaza elemente 2D in module de baza tridimensionale

Modulele de baza sunt asamblate apoi in constructii de tip puzzle, kinetice sau metamorfice

Acest mediu permite investigarea si descoperirea de proprietati spatiale miraculoase



XColony Game Systems



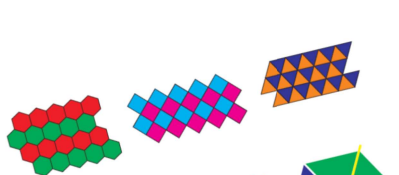
CONCEPTE
referitoare la
spatiu



Structura

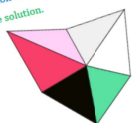
XColony Game Systems

PROCESE de gandire pentru intelegerea relatiilor din si intre structurile spatiale

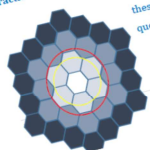


2.2. Regular Polygons

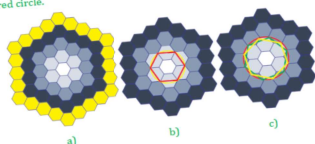
Practice A. Analyze the image on the right. You may notice that a regular hexagon can be obtained by gluing together 6 equilateral triangles. Can you fold it, such that same color triangles overlap, using the yellow marks as mountain crests and the white marks as valley crests?
(Apply first the juxtaposition of the triangles of same color)
The next picture hints the solution.



Practice B. In the picture below, there are special concentric shapes of different colors. Use hexagonal pieces to these structures and answer the following questions:



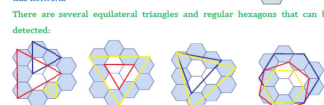
- How many hexagonal pieces would you need to build the next exterior ring (the fourth one)?
 - The yellow circle seems to pass through 6 of the vertices of the cyan hexagons. Can you argue if this is true or not?
 - The red circle seems to pass through 12 of the vertices of the cyan hexagons. Can you argue?
- a) There are 6 vertices and 6 edges. On each edge there are 3 hexagons that are not corners. The answer is: $6 \times 6 \times 3 = 24$.
- b) The red hexagon has the side length equal to the diagonal of the hexagons on the grid; its angles are equal to the angle of the hexagons on the grid (two halves of those); the red hexagon is regular therefore inscribable.
- c) Use symmetry; the yellow and the green hexagons have the same side lengths and are equally distanced from the center. They are inscribable in the same red circle.



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Practice C. The network on the right was obtained using 12 regular hexagons of the same size.

- Build this shape using paper cut hexagons.
- Identify as many as possible types of regular polygons that can be built using only the vertices of this network.



2.3. Polyhedra. Convexity and Concavity

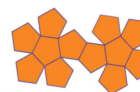
Practice A. Apply the polyhedron definition to verify why the geometric solids in Figure 1 are classified as polyhedra or not.



Figure 1. Examples and counter-examples of polyhedra

The first object in Figure 1b has one edge that is common to more than two faces. The second one does not have polyhedral faces.

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Practice B. Build the dodecahedron model: cut the paper template previously shown on the exterior edges, fold the inner crest marks and tape the matching edges.



Yes. The result is a convex polyhedron. It has 7 vertices, 15 edges and 10 faces.

Practice C. The figure on the right was obtained by joining together 10 equilateral triangles. Draw this figure on a paper, then cut off its exterior, draw the crests/marks and connect aligning edges using adhesive tape to obtain a polyhedral model.

- Check if the obtained polyhedron is convex.
- How many vertices, edges and faces did you obtain?



Practice D. Use H4 elements (chains of 4 regular hexagons having an "S" shape) to construct 7 modules as illustrated on the right. Imagine each module as a polyhedron, thinking that all of its faces are "full".

a) Is this module a convex polyhedron? Explain why. Yes. It is a convex polyhedron as it is obtained from the regular tetrahedron by removing the corners sequentially. Removing of a corner preserves the convexity at every step. This is a variant of a more general property of convex polyhedra: the intersection of two convex polyhedra is a convex polyhedron.

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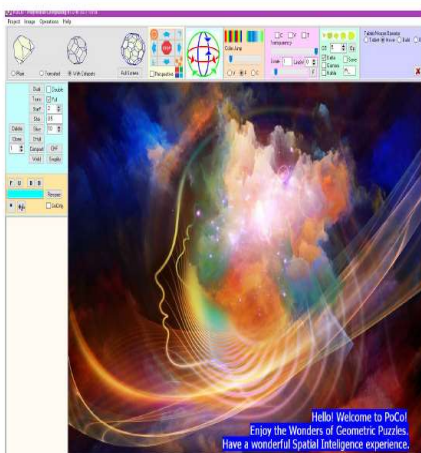
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Structura

XColony Game Systems

PROCESE de gandire pentru intelegerea relatiilor din si intre structurile spatiale

I. Hello PoCo!



PoCo is a computer program that allows you to play with polyhedra. Do you remember playing with cubes when you were a kid?

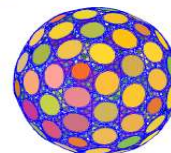
II 2. PoCo Transformations

We have already encountered dual transformation and truncation. The dual transformation is well known for convex geometric objects. We extend the known definition to complex geometric objects: colonies or ensembles of polyhedra.

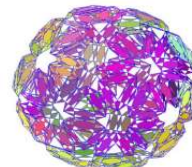
We shall consider the transformations as described in the introductory chapter and we shall learn how to use them in combinations to create interesting objects.

Example 1. Start with a ITC module and apply five operations including Dual, Trunc, and StarF.

A. Dual, Trunc, Trunc, Trunc, StarF(5) generates

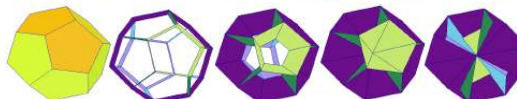


B. Trunc, StarF(5), Dual, Trunc, StarF(5) generates

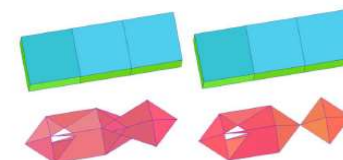


Find new combinations of five transformations that will have different outcomes.

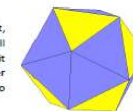
Example 2. Start with a D module and apply Star transformation with parameters: 0.1, 0.5, 1 and 2.



Both objects look similar, but their dual transformations will reveal the difference.

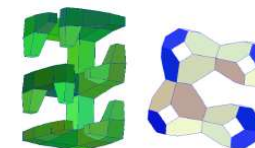


Simplify transformation. Construct an I module, make one clone of it, recolor one in blue and one in yellow. Finally join the two objects. You will probably see something like this. If you rotate the object you should see it flickering. The object has 12 double vertices and 20 double faces. In order to restore vertices to one copy only apply the Weld transformation and convert faces into simple polygons, apply Simplify transformation.



Practice. Create objects where faces are overlapping due to proximity. For instance, adding one more cube to this structure to create a square with 3 cubes on each side will generate such proximity. Analyze who the dual transformation will reveal that information. Create a copy, weld and simplify it and notice the difference.

Puzzles. Reconstruct the following structures. Can you also create their "connected" versions?



Use the Help/Manual documentation to experiment with all transformations and operations. Propose similar puzzles.

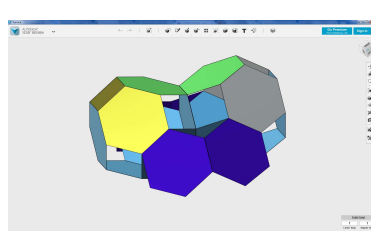
PoCo – jocul virtual care permite cu joaca cu poliedrele foarte complexe, asa cum ne jucam cu cuburile copilariei

Structura

Proiectare asistata - notiuni introductive

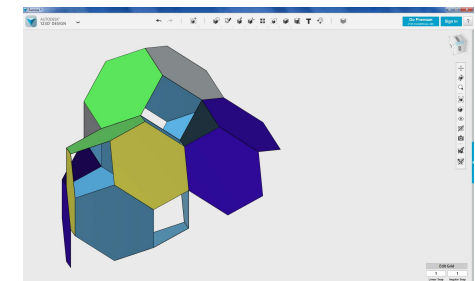
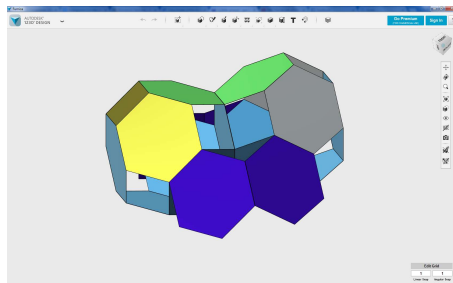
Participantii:

- sunt initiati in tainele proiectarii de structuri spatiale
- primesc instrumentele care le permit sa comunice despre structurile, etapele si procesele pe care le-au parcurs
- reprezinta mental tot ce a fost obiect de joaca pe parcursul etapei XColony continuand, intuitiv, sa inteleaga relatiile dintre structurile imaginate
- realizeaza constructii simple intr-un program de proiectare asistata care vor fi materializate prin 3D printing



Structura

Proiectare asistată - notiuni introductive



Structura

Robotica si 3D printing

Participantii

primesc notiuni elementare despre robotica si 3D printing

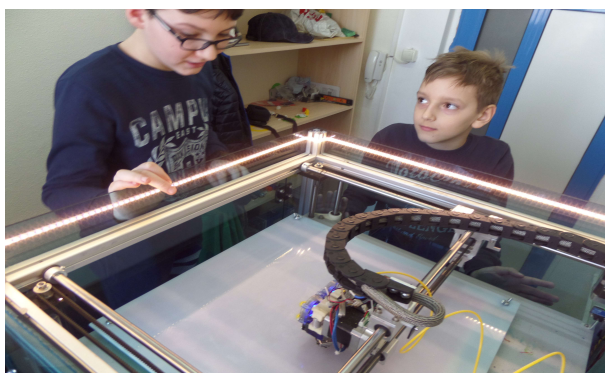
Cunostintele dobandite se pot aplica in domenii care includ:

Arhitectura

Inginerie

Arte

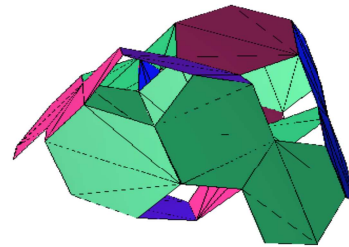
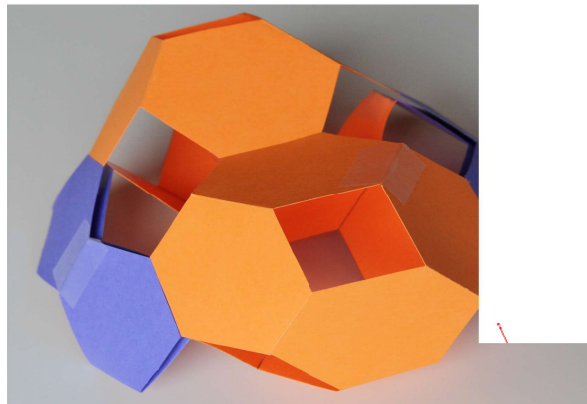
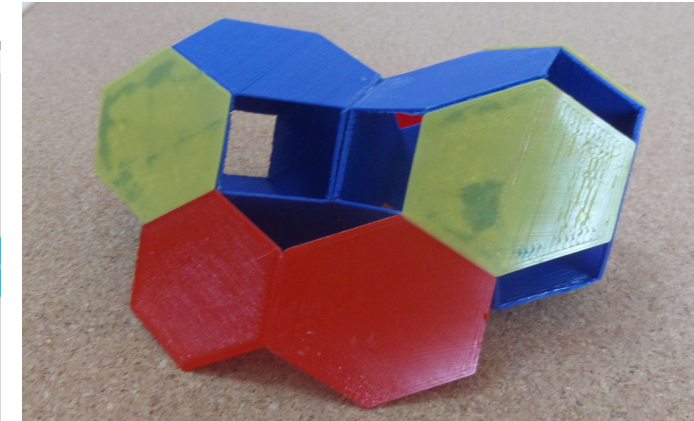
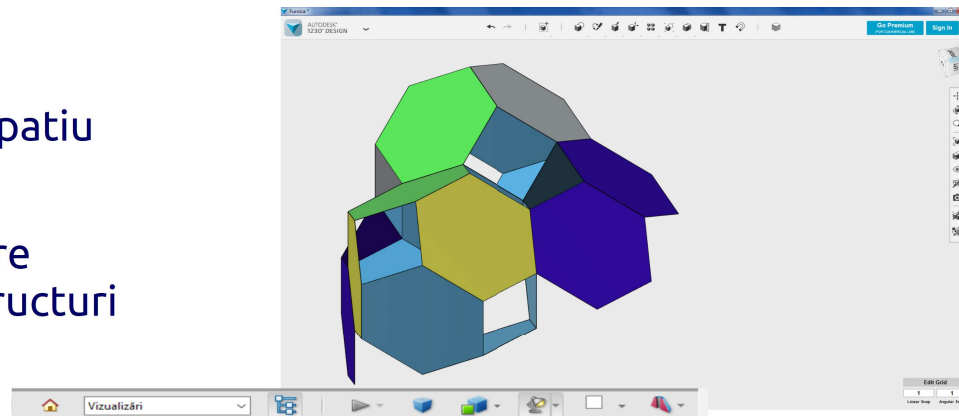
Medicina



Pregatim copii pentru profesiunile secolului 21

Concepte referitoare la spatiu

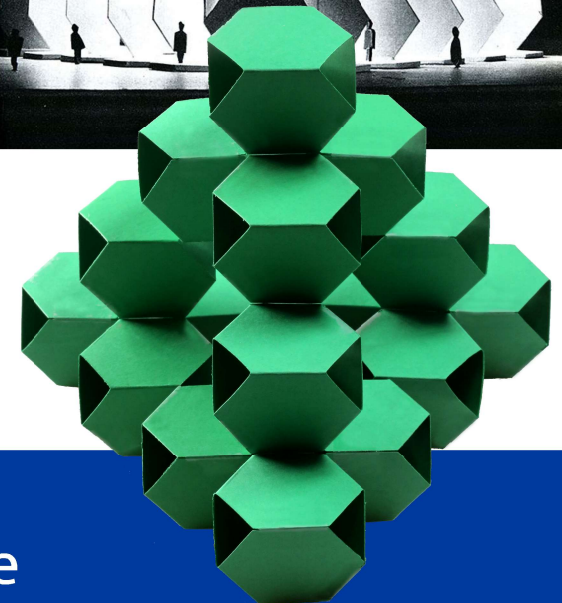
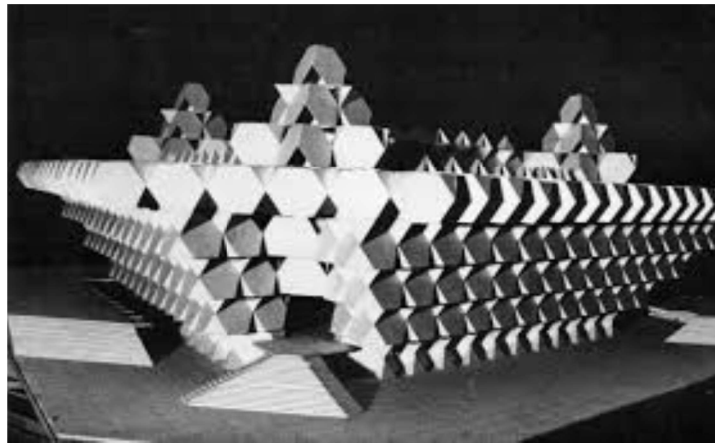
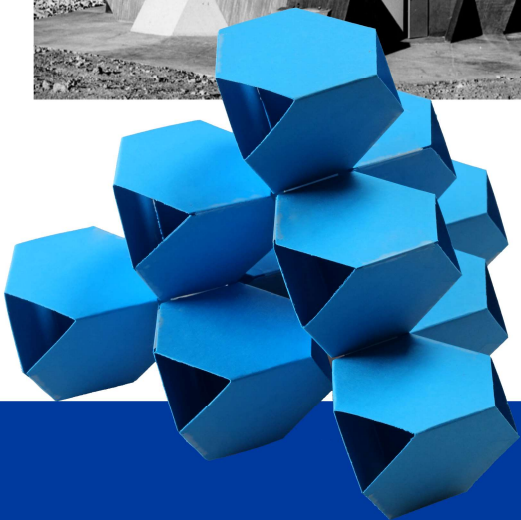
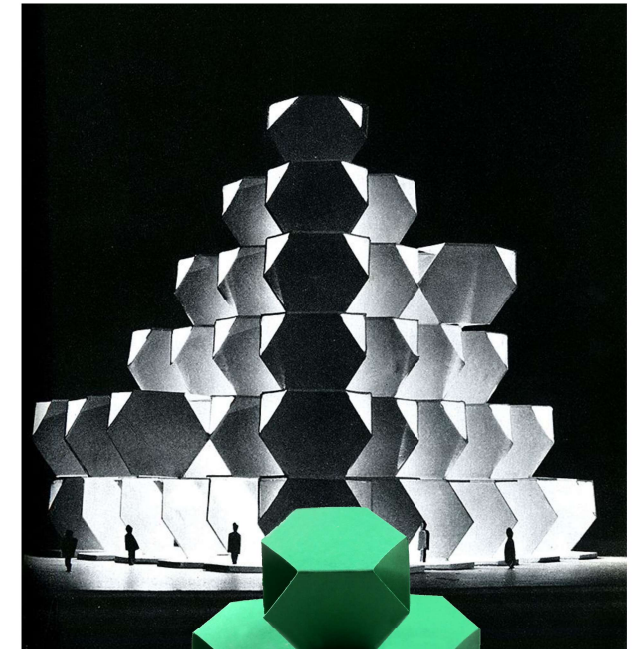
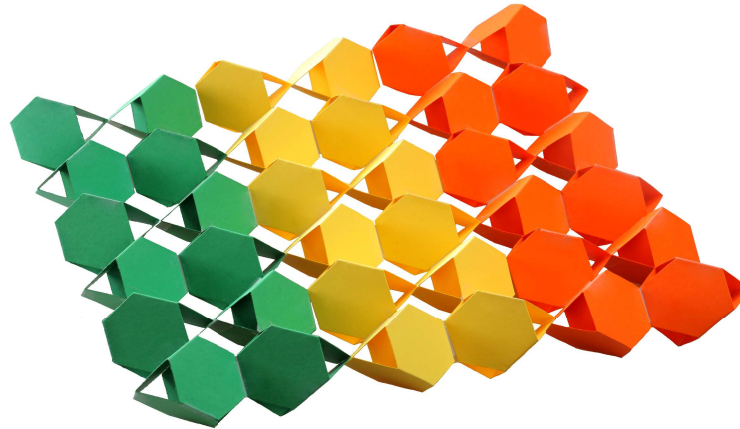
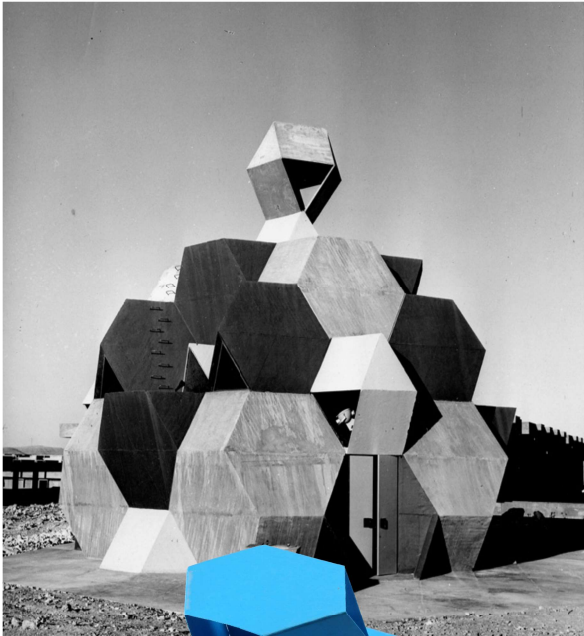
Procese de gandire despre structuri si relatii intre structuri



CAPACITATE DE COMUNICARE despre aceste structuri si despre relatiile dintre ele sau dintre acestea si spatiul inconjurator

Materializarea proiectului

Pregatim copiii pentru profesiunile secolului 21



Rezultate

Îmbunătățește capacitatea de a opera cu elemente spațiale cu 17%
(măsurată după 8 sesiuni prin teste de spațialitate)
Creste cu 26% pentru argumentare și raționament

Avantaje

Dezvolta într-o configurație unică inteligență multiplă:

Logico-matematic

Vizual-spațial și kinestezic

Oferă un mediu de învățare pentru tehnologii prioritare în secolul 21

Concluzii

Integreaza informatii virtuale si reale pentru a asigura o invatare fluenta si simpla, pe canale informationale multiple

Ofera o platforma de manifestare a individualitatii si creativitatii fiecarui participant

Genereaza puncte de cunoastere intre diferite domenii ale stiintei

Platforma de invatare spatiala care integreaza toate modulele propuse si completeaza sistemul educational existent cu elemente non-standard