

TEMPLATE for BEST PRACTICE EXAMPLES

1. Name of the project:

Enriching the school environment with the Fibonacci sequence and golden ratio design

2. Subjects covered from STEAM areas:

Software application
Digital design
Virtual reality
Urban planning
Architecture
Landscaping
Geodesy and geomatics
Construction and civil engineering
Graphic design
Engineering
Technical drawing

3. Target group (age range and size of the group):

16-19 age range
5-10 size of the group

4. Duration of the activity:

3-4 weeks

5. Key words:

Fibonacci sequence, spiral, natural design, artistic design, technical drawing, virtual reality, geodesy and geomatics, field survey, stake-out, transforming school environment, golden ratio, curve.

6. Key sentence describing context of the activity, followed by short description (200 words):

The aim of this activity is transforming the school environment into a more natural, lively and happy place.

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Using geodetic measurement hardware take a field survey of the school outdoor environment and create a digital plan of it. This includes measurement of a facade with traditional measuring techniques or/and using field photogrammetry.

Using modern software for technical drawing, create a more eco friendly, natural and artistic re-design.

Use geodetic field hardware to create a design and place it into the school surrounding and real outdoor coordinates.

Enjoy the new environment!

*For schools without geodetic equipment, but that have CNC and/or 3D laser printer, the projected design could be sprayed / painted / filled onto the interior or exterior wall / school yard by using the printed pattern board (mold or matrix for the design pattern).

7. Description of the activity environment, including the list of materials and tools needed:

- 1. Computer cabinet with insatalled software for technical drawing (AutoCAD, BricsCAD, QGIS etc)
- 2. School yard / field / polygon / garden that needs creative and artistic reconstruction
Also > School façade, corridor, wall, etc.
- 3.
 - 3.1 Tools for geodetic field survey and stakeout (GNSS, total stations, theodolites, etc);
 - 3.2 CNC and/or Laser printer
 - 3.3 Paint roller, brush, spraying can, etc.

8. Step by step, detailed description of the activity, including teaching and learning strategies:

The goal of the project is to imprint the natural design into the school environment using the golden ratio and Fibonacci sequence coding.

As a secondary level technical school that educate pupils in the field of Architecture, Construction, Civil engineering and Geodesy, our main proposal for project strategy would be as follows:

- 1. Using geodetic field equipment, survey with your pupils the outdoor area that needs restoration / beautification / renovation / etc.
- 2. Create a digital plan of the area using the available software
- 3. Determine design that you would like to incorporate into the area and draw it onto the digital plan

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- 4. Extract coordinates of the drawing and by using geodetic field equipment stake out the design
- 5. The last stage would be to fill / pave / paint / decorate the marked design and thus turn the virtual into physical reality

For schools without geodetic equipment, but that have CNC and/or 3D laser printer, the projected design could be sprayed / painted / filled onto the interior or exterior wall/school yard by using the printed pattern board (mold or matrix for the design pattern):

- 1. First talk with your pupils what outdoor area or which exterior / interior wall would you like to “alive” and implement the natural design of the golden ratio onto it
- 1.1 By using a camera, create a photo of the desired wall / area. *If possible, implement the basics of photogrammetry for creating stereo paired images*
- 2. Determine what kind of a design would you like to implement, and create the drawing for the matrix (frame, mold) by using the software for technical drawing (.dwg, .dxf file)
- 3. Print the matrix / mold using CNC or 3D laser scanner
- 4. By using material of your choice (paint, color spray, clay, concrete, plaster, etc.) implement the design onto the desired area

9. Learning objectives/competencies:

Learn digital design
Create virtual reality
Experience field realization of the digital project
Enhance creative thinking
Connect virtual dataset with real world
Experience all steps in project realization
Know how to implement natural design

10. Evaluation / Assessment guidelines:

1. The before / after impression
Pictures of the area before and after the implementation of the golden ratio design
2. Mathematical quality of the design
Proximity to the 1.618 constant, harmonization of the design to the Fibonacci sequence
3. Artistic impression of the design
4. Complexity of the project and number of students and equipment being used
*How many students and how many different classes have been involved?
How many different software and hardware applications have been used; Variety of the materials and resources*

11. Lessons learned:

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1. Field survey
2. Technical drawing
3. Creating digital plan
4. Geometry of nature
5. Fibonacci sequence, golden ratio coding
6. Staking out of the project
7. Graphic design
8. Usage of geodetic equipment
9. Usage of CNC printer
10. Usage of 3D laser printer
11. Drawing curve
12. Mathematics in arts

12. Additional information/Links:

“The Fibonacci sequence is one of the most famous formulas in mathematics. Each number in the sequence is the sum of the two numbers that precede it. So, the sequence goes: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so on. It’s been called “nature’s secret code,” and “nature’s universal rule.” It only needs to take a look at the pattern it creates and you can instantly recognize how this sequence works in nature. This famous pattern shows up everywhere in nature including flowers, shells, pinecones, hurricanes, and even huge spiral galaxies in space. In graphic design, we refer to it as the Golden Ratio. It can be applied to everything from logo design, print design and website design.”

<https://clevelanddesign.com/insights/the-nature-of-design-the-fibonacci-sequence-and-the-golden-ratio/>

13. Contact person:

Miloš Đorić
GTŠ Neimar, Niš
geodet@mail.com
+381621235111