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STEAM CONNECT

Title of the STEAM Unit: Rosette windows

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RELATED SUBJECTS	GRADE RECOMMENDATIONS	TOTAL ACTIVITY TIME	LEARNING OBJECTIVES DURING THE LESSON SUBJECT-SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON
mathematics, informatics, history, art	13 - 15 year old pupils, Primary school (8th year, SŠ. 1st year)	360 min	circle, circle, intermediate circle center of the circle radius and diameter of the circle and their relation relative position of the circle and the line intersection, non-intersection, tangent to the circle, tangent to the circle, tangent to the circle, axis, their properties, distance of the center of the circle from the axis circular arc, circular section, circular segment The Ludolphine number and its	MATH: similarity, be able to divide a constructed line segment in a given ratio. COMPITER SCIENCE: Search the internet for relevant resources. Basics of working with GeoGebra, understand the concepts of free, and bound point. MATH: understand the concepts of circle, circle, arc of circle, be able to determine their

|			approximate values π ≐ 3,14 (resp. 7/ 22 =◌) content and circumference of a circle, length of a circle, S ◌ ◌ ◌r◌r ; o = 2πr = πd	length and content. Relative positions of circles and circles and lines. **COMPUTER SCIENCE:** In GeoGebra, be able to construct a figure composed of circles and lines so that by changing the size of a "changing" line, the entire drawing changes in a given proportion and the individual geometric figures maintain their relationships to each other resulting from their relative positions.

OVERVIEW: TOPIC & PURPOSE

Within the thematic unit of the circle pupils are to proceed unconventionally and look for given geometric elements in architecture. These appear in large numbers in the Gothic period in church rosette windows, these can have different artistic treatments. The task of each team working on this topic is to find a building in the landscape where a rosette window can be observed. Understand its structure and try to redraw it as faithfully as possible in GeoGebra, so that the relationships and positions are preserved. Based on this drawing, model the window in a predetermined scale using plasticine or 3D printing and determine the amount of material used by calculation. The theme can also be treated as a poster, which will be used to learn about the history of the selected building.
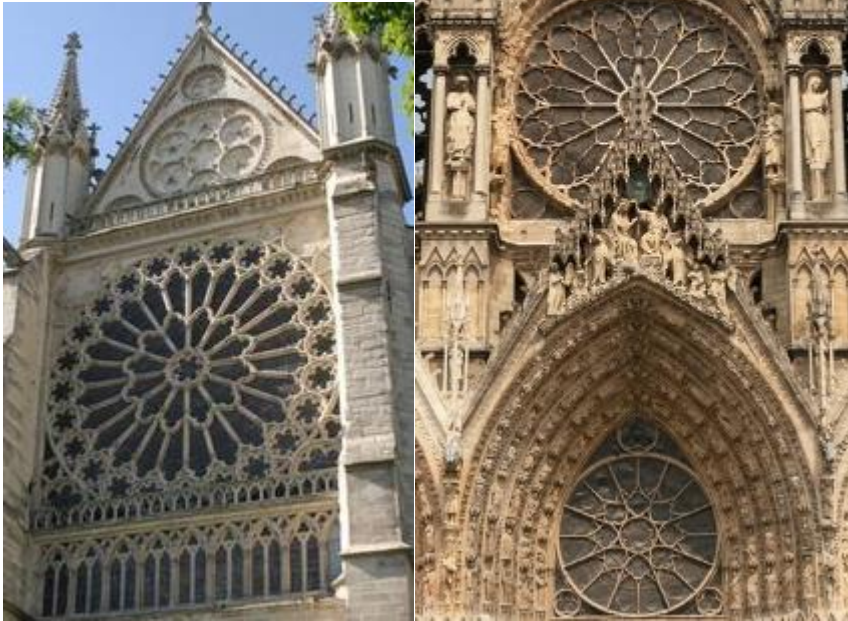
ACTIVITY PREREQUISITES

Know the concept of similarity, be able to divide by construction a line segment in a given ratio. Search the internet for relevant resources.
Know the basics of working with GeoGebra, understand the concepts of free and constrained points.

STEAM ELEMENTS

ELEMENT 1: context presentation	Recognize in architectural works from the Gothic period structures that use circles to create rosette elements on buildings
ELEMENT 2: creative design	Design a sequence of steps. Find relationships between circles and lines in structures, and based on these relationships, propose a procedure to construct them in dynamic geometry.
ELEMENT 3: emotional and social learning	Problem solving, creating and verifying hypotheses, teamwork, being able to divide roles in a team, working with time-management.

STEAM SUBJECT ELEMENTS

STEAM SUBJECTS	SCIENCE	TECHNOLOGY	ENGINEERING	ARTS	MATHEMATICS
SHORT INTRODUCTION TO RELATED SUBJECT ELEMENTS	Understanding the interrelationships in the presented architectural structure.	Manual production of a rosette window on the basis of a drawing.	Working with dynamic software (GeoGebra).	The circle in architecture, its use in the Gothic period.	On the basis of the relationships for the calculation of the perimeter and content, estimate and then calculate the necessary amount of material for the production of a mock-up of a rosette window.

SYLLABUS

LESSONS	SUBJECTS	TOPIC OF THE UNIT	LEARNING OBJECTIVES DURING THE LESSON: SUBJECT SPECIFIC COMPETENCIES	LEARNING OBJECTIVES AFTER THE LESSON: STEAM COMPETENCIES

1	History, Art	The largest or most famous/interesting buildings with interesting rosette windows on it.	Divide into groups of three, draw a country, search for a "matching" building via the internet.	Pupils should be able to orient themselves in different building styles, recognize elements of Gothic in architecture.
2	Computer science	Structural divisions in GeoGebra a line segment in a given ratio.	Understand the relationships between constructed figures in dynamic geometry (a free point, a point bound to a given figure, a point as the intersection of two other figures).	Pupils should know how to use technology effectively in their work.
3	Computer science	Dynamic drawings based on a specific photo.	The using of simple constructions.	To construct a functional dynamic drawing.
4	Mathematics	Calculations of the circumference of a circle and a circular section.	Circle, circular section, use of Ludolphine number and its approximate values $\pi \approx 3.14$ (resp. $7/22 = $) content and circumference of a circle, length of a circle, $S = \pi r^2$; o = $2\pi r = \pi d$.	To understand working with formulas for calculations, identifying individual part units in the whole.
5	Art	Creation of a poster - capturing the individual steps of the work.	Modelling using a prepared template.	To follow the procedure according to the drawing.

		Creation of a rosette window.		

INSTRUCTIONAL PLAN BY LESSON

LESSON 1   History, Art (45 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (10 minutes)	Dividing pupils into groups of three and enabling them to draw a country from a number of given countries.	- Cards to be drawn into groups. - Assignment instructional cards for each group.	Pupils will be able to understand the given instructions and draw from a group of countries.
LEARNING ACTIVITIES (30 minutes)	Based on the country pupils draw, they search for the largest or most famous or interesting building in that country that has a rosette window on it.	Internet connection, PC.	Pupils will be able to use the internet to find relevant resources effectively.
WRAP-UP & EVALUATION (5 minutes)	Justification of the selected construction.		Pupils will be able to argument and justify their selected examples of rosette windows according to given criteria.

LESSON 2   Computer science (45 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (5 minutes)	Reviewing work principles in GeoGebra	GeoGebra, pc	Pupils will be able to revise working principles and functionalities of GeoGebra.
LEARNING ACTIVITIES (35 minutes)	Structural dividing in GeoGebra a line segment in a given ratio.	GeoGebra, pc	Pupils will be able to understand the relationships between constructed figures in dynamic geometry (a free point, a point bound to a given figure, a point as the intersection of two other figures).
WRAP-UP & EVALUATION (5 minutes)	Verification of correctness of construction.		

LESSON 3   Computer science (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES

INTRODUCTION (5 minutes)	Review the concepts of free, partially constrained and constrained objects in dynamic geometry.	GeoGebra, PC	Pupils will be able to understand the relationships between constructed figures in dynamic geometry (a free point, a point bound to a given figure, a point as the intersection of two other figures).
LEARNING ACTIVITIES (80 minutes)	Creations of a dynamic drawing based on a specific photo.	GeoGebra, PC	Pupils will be able to use technology - GeoGebra effectively in their work.
WRAP-UP & EVALUATION (5 minutes)	Reflexive dialogues between the teacher and groups of pupils. Verification of correctness of construction.		Pupils will be able to reflect and revise their constructions of dynamic objects.

LESSON 4   Mathematics (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (30 minutes)	Deriving relations for calculating the circumference of a circle and part of a circular arc.	Lanyard, ruler, various predominantly "cylindrical" shapes, Ruler, calculator	Circle, circular section, uses The Ludolphine number and its approximate values $\pi \approx$ 3.14 (resp. $\frac{22}{7}$) content and circumference of a circle, length of a circle, $S = \pi r^2$; o = $2\pi r = \pi d$.
LEARNING ACTIVITIES (50 minutes)	Identifying circles and circular sections in a constructed rosette and	Ruler, calculator	Circle, circular section, use of The Ludolphine number and its approximate values

	calculating perimeters in the selected scale.		$\pi \approx 3.14$ (resp. $7/22 = \pi$) content and circumference of a circle, length of a circle, $S = \pi \cdot r \cdot r$; $o = 2\pi r = \pi d$.
WRAP-UP & EVALUATION (10 minutes)	Reflexive dialogues between the teacher and groups of pupils on How geometric construction is related to and can be helpful with computational geometry?		Pupils will be able to reflect on their learning and present arguments.

LESSON 5   Art (90 min)

TIME PLAN	TEACHING & LEARNING ACTIVITIES	MATERIALS	LEARNING OBJECTIVES
INTRODUCTION (5 minutes)	Presenting instructions regarding the assignment and the materials used.	Drawing papers, glue, printed materials related to the topic, air-drying modelling compound (Play Doh)	Pupils will be able to go through and understand a graphic processing of the topic - create an educational poster.
LEARNING ACTIVITIES (45 minutes)	Creation of a poster on the given theme and a model of a rosette window in the chosen scale.	Drawing papers, glue, printed materials related to the topic, air-drying modelling compound (Play Doh)	Pupils will be able to create an artistic design of the educational poster.
WRAP-UP & EVALUATION (40 minutes)	Reflective dialogues between the teacher and groups of pupils.	Created posters and models.	Pupils will be able to reflect on their work and present the acquired knowledge and the results of their work.

	Presentation of all the work done so far by each group.		

EVALUATION PLAN BY LESSON

LESSON	EVALUATION CRITERIA	EVALUATION METHOD
1	Do pupils understand the assignment?	Dialogue between the teacher and pupils.
2	Are pupils able to work with the GeoGebra dynamic software?	Explanations of taken steps and observing their work.
3	Is the group able to discover the interrelated content connections and then use them in the design?	Observation, peer review of created drawings.
4	Is the group able to use the mathematical relationships learned to solve a unique problem?	Verification of the correctness of the analogue calculation using dynamic geometry.
5	Did the pupils work together, were they able to divide the work in groups, communicate with each other and link their parts? Were they able to present their work?	Observation, self-assessment of groups/pupils.

NOTES

It is possible not to from drying matter, but to print them via 3D printing

ACTIVITY SHEETS TO BE LINKED

EVALUATION MATERIALS TO BE LINKED

REFERENCES / SUPPORTING MATERIALS TO BE LINKED

Sample of pupils' works:

https://www.geogebra.org/classic/vkvuwpxj