



Co-funded by the
Erasmus+ Programme
of the European Union



COMPENDIUM OF INTERDISCIPLINARY ACTIVITIES SUITABLE FOR FIELD EDUCATION

**Jan HERCIK, Eva KONEČNIK KOTNIK, Smiljana ĐUKIČIN VUČKOVIĆ, Radmila
PRCHAL PAVLÍČKOVÁ, Igor ŽIBERNA, Jelena MILANKOVIĆ JOVANOV, Ljubica
IVANOVIĆ BIBIĆ, Anđelija IVKOV-DŽIGURSKI, Petr ŠIMÁČEK**



Elaboration of this publication was supported by the project **LIFedu - Learning through Interdisciplinary Field Education** (2019-1-CZ01-KA203-061379), co-funded by the European Commission within the Erasmus+ programme.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Activity 1 - Scan, get out, meet.....	4
Activity 2 - Orientation as a fun occupation	9
Activity 3 – Culture through the lens.....	17
Activity 4 – Urban climate	23
Activity 5 – Biogeographer	27
Activity 6 - Hydroclimatologist	32
Activity 7 – My city through VR	37
Activity 8 – Learning geography and flying.....	44
Activity 9 – Wine routes	49
Activity 10 – Back to the past	55
Activity 11 – Trails of culture	61
Activity 12 - Geophysicists - If geography was easy, they'd call it physics	66
Activity 13 - Novi Sad Fair: significance and sustainability	73
Activity 14 - Measuring water pollution in the city area	78
Activity 15 – Museum through AR.....	84
Activity 16 - My city through tourist locations	87
Activity 1 - Light pollution research in the bright part of the day	94
Activity 2 - Light pollution research by night.....	102
Activity 3 - Sound degradation of the environment.....	111
Activity 4 - Visual degradation of the environment.....	119
Activity 5 - Intergenerational cooperation or “together we are strong”	128
Activity 6 - Mindfulness to enhance (geographic) curiosity.....	136
Activity 7 - But where in the toti Maribor (Urban tourist visit planner).....	143
Activity 8 - Is this story true (spatial development of the city)	160
Activity 9 - Urban plants - a research walk	165
Activity 10 - Sustainable development live - project work	172
Activity 11 - What's going on downtown (mapping the age and functions of buildings).....	181
Activity 12 - We protect waters	187
Activity 13 - Urban river banks-conflicts and activities	197
Activity 14 - Creative measuring latitude	204
Activity 15 - Burdening agro-ecosystems	216

Activity 1 - Scan, get out, meet

Theme	Scan, get out, meet
Topic (incorporation by curriculum)	Orientation and coping in space; Getting to know the local environment; Historical development of the settlement
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	1 hour in the field + 1 hour in the classroom
Cross-curricular links	Geography, History, Biology, Informatics, Biogeography, Geoinformatics, Spatial planning
Organizational forms	Work in groups
Staffing	Geography teacher and one class

Teaching aids	Worksheet, smartphone, pen and notebook
Place of realisation	The tasks were done on the example of Novi Sad (applicable in other cities with minor corrections). This is the part of the city where the Railway Station, the Railway Park and the Fair are located. The task can be applied in other parts of the city, with the correction of coordinates and objects that want to be studied.
Environment's specifics	

Required entry knowledge and skills of students	Using smartphones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field about the characteristics of the local environment in which they live and where the school is located; 2. They also use applications that will make it easier for them to navigate the space, and get to know the flora of the local environment; 3. Students get to know the historic development of the observed settlement; 4. They study how much in the past the judged locations have affected and how much they affect the environment today. 5. Students expand their knowledge in the field of local environment
Theoretical basis	GPS receivers are the most important devices for determining the position in unknown terrain or on the open sea. They are freed from all the defects of the compass. They can be used to accurately determine the landing point, its position in relation to the objects shown on the topographic map, as well as the route with several return landmarks (Tadić, 2019; available at https://zuns.me/sites/default/files/Geografija%20%20-%20prirucnik%20%5bunutra%5d.pdf).
Conclusion (evaluation)	After the outdoor work, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.

Individual approach suggestions	Talented student	Less-gifted student
	Individual work	Inclusion of students in a stronger group

	They will have the task to make a quiz or association on a given topic	
--	--	--

Activity scenario	Teacher activities	Students' activities
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
task 1	The teacher points out the application that is necessary for the realization of the task and takes the students to the school yard.	Based on geographical coordinates or QR code, with the help of a smartphone, they search for 3 given locations.
task 2	The teacher goes to one of the locations with the students and explains what was in that place in the past, how the construction affected the development of urbanization in this part of the city and how it affects the environment today. Geographic coordinates or QR codes , search for 3 default locations.	Based on the teacher's presentation, students draw conclusions and write them in their worksheets. After the first location, the second and third are found, and then it is researched: what this environment looked like in the past, how urbanization took place, whether development flows were degrading or improving and whether the environment is endangered.
task 3	The teacher shows a color photograph of one location.	Students recognize the location, go to it and answer the questions asked in the worksheet.
task 4	The teacher points out the application that is necessary for the realization of the task.	Students use the PlantNet application to find plants that are in a given area.
task 5	It explains how the mutual influence of certain factors that affect the environment and the uninterrupted performance of functions in a certain space should be observed.	They research and make suggestions on how the environment in the given locations can be improved.
	Possible correction of the results of assignments in class.	The students present the prepared presentations from the field in class, presenting the results of the research they came across while working in the field.
Implementation risks		weather conditions, Internet connection
Note:		

Key to the worksheet:

SCAN. COME OUT AND MEET

Task 1 Based on geographic coordinates or QR code, use your smartphone to try to find the given locations using Google Maps. Write the names of the lines next to them.



45.264494, 19.829304
(45°15'52.2"N 19°49'45.5"E)

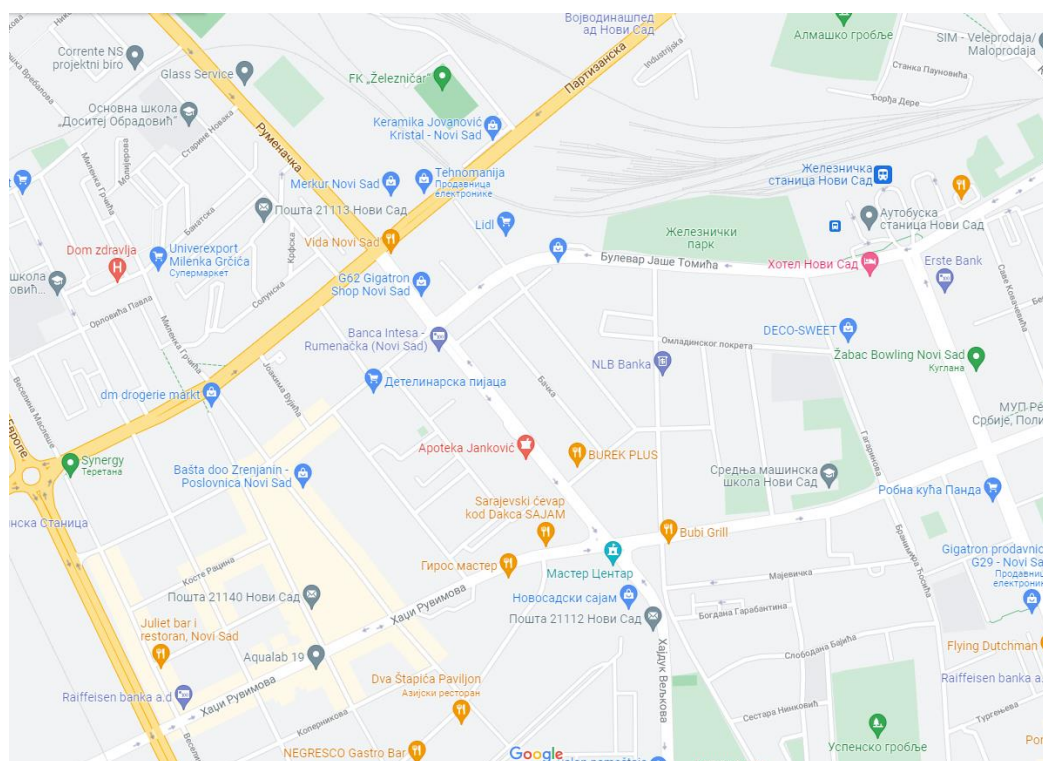


45.264405189438065,
19.825356205289292 (45°15'51.9"N
19°49'31.3"E)



45.258053304968,
19.823387036286046 (45°15'29.0"N
19°49'24.2"E)

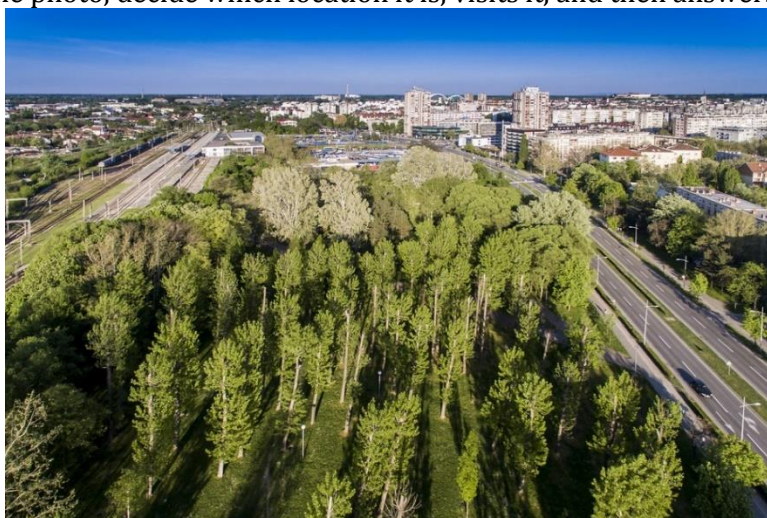
Task 2 On the map below, mark the first location in red, the second in blue and the third in green. After that, fill in the table given in the attachment below the photo.



LOCATION	What was in a given location in the past?	How did the construction affect the	How does this location affect the
----------	---	-------------------------------------	-----------------------------------

		development of urbanization in this part of the city?	city's environment today?
1. _____			
2. _____			
3. _____			

Task 3 Looking at the photo, decide which location it is, visit it, and then answers the given questions.



- What is the name of the location you came to? _____
- What is the name of the festival that has been traditionally held at this location since 1998?

- Do you think the location is safe for younger children? If you think it is not safe, why is it so and what would you suggest to change?

- Does the location has a sufficient amount of waste bins, benches and is there enough space for recreation?

Task 4 Download the PlantNet app from the Google Play Store. After that, it is necessary to choose 5 different types of plants and write on the lines which plants are in question, including their Latin names and the origin of the plants.

- _____
- _____

3. _____
4. _____
5. _____

Task 5 Since you have visited the listed locations, write down your observations about them in the given field (how they affect the environment, what you would do to improve the same, whether the locations are accessible for people with disabilities, etc.).

Activity 2 - Orientation as a fun occupation

Theme	Orientation as a fun occupation
Topic (incorporation by curriculum)	Orientation and managing in space; Herbarium
Target group	ISCED2 (age 11-12), ISCED3 (age 15-16)
Duration (outdoor, indoor part)	1 hour in the field + 1 hour in the classroom
Cross-curricular links	Biology, Informatics, Biogeography, Geoinformatics
Organizational forms	Work in groups
Staffing	Geography teacher, Biology teacher and one class

Teaching aids	Worksheet, smartphone (with GPS and compass), watch, pen and notebook
Place of realisation Environment's specifics	The tasks were done on the example of the Danube Park in Novi Sad (applicable in other parks in Novi Sad, but also in other cities with minor corrections). It is a part of the city with a landscaped park space.

Required entry knowledge and skills of students	Using smartphones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the possibilities of orientation in nature. Orientation is possible with a compass, a map, with the help of the sun, watch and shadow, trees and other plants, animals, etc. 2. They also be able to use GPS, which make it easier for them to navigate in space. 3. While visiting the park, students have the opportunity to make an online herbarium and get to know the plant world in landscaped spaces. 4. Students expand their knowledge in the field of spatial orientation and botany.
Theoretical basis	The concept of orientation involves an awareness of the location at which we find ourselves at a certain moment in the space. In other words, on-ground orientation means determining one's own location (standing point or direction of movement) in relation to the sides of the world, relief landforms and earth objects as static phenomena. There are several types that are, ways of orientation in space, among which the most commonly used are: orientation using: sticks, the Sun, the Sun and a clock, according to the North Star, the Moon, phenomena in nature, phenomena in society, landmarks, compasses, GPS, etc. (Markoski, 2018; Lukić et al, 2012.).
Conclusion (evaluation)	After the lesson in nature, students should make an online herbarium by placing the photographed plants in pre-obtained schemes and writing the basic characteristics. On the map of the Danube Park, students should mark the localities where the plants were painted, and mark the geographical coordinates of those localities. Discussion and possible correction of results.

Suggestions of individual approach	Gifted students	Students below average
------------------------------------	-----------------	------------------------

	<p>Individual work</p> <p>They will have the task to make a presentation in PowerPoint on which there will be an interactive map. Interactive map with marked localities, where photos of plants from the herbarium and localities where moss, anthill and the like were found will be linked by a hyperlink.</p>	<p>Inclusion of students in a stronger group</p>
--	---	--

Description of activities	Teacher activities	Student activities
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
Task 1	The teacher takes the students to the Danube Park and explains the use of a compass on a smartphone	Students should determine the sides of the world based on a compass.
Task 2	The teacher explains to the students the orientation with the help of a geographical map and the use of GPS.	Based on the teacher's presentation on the city map, the students find the park in which they locate and determine the sides of the world with the help of a map. They find the required objects and enter their geographical coordinates. They check if it matches the result they got with the compass.
Task 3	The teacher explains the orientation with the help of the Sun, the watch and the shadow.	Students at several locations in the park use the sun, watch and shadows to determine the sides of the world. Compare the results with the results obtained with a compass.
Task 4	The teacher shows orientation with the help of plants and animals.	Students try to find a tree in the park with a pronounced density of canopy, moss or anthill and photograph them.
Task 5	The teacher explains to the students the importance of certain plants in the park. The teacher connects them with the ethnological heritage and explains how to photograph plants for the needs of the herbarium.	Students explore and photograph at least three different plants each, in order to have as many in the herbarium as possible.
	Possible correction of the results of assignments in class.	Students prepare an online herbarium and enter the locations where the plants were photographed on the map
Possible implementation risks		weather conditions, Internet connection
Note:		

Key to the worksheet:

ORIENTATION AS A FUN OCCUPATION

Task 1. Based on a compass on a smartphone, determine the sides of the world and enter the geographical coordinates of the following objects: Pozoriste mladih, Museum of Vojvodina, Danube River and Bulevar Mihajlo Pupin

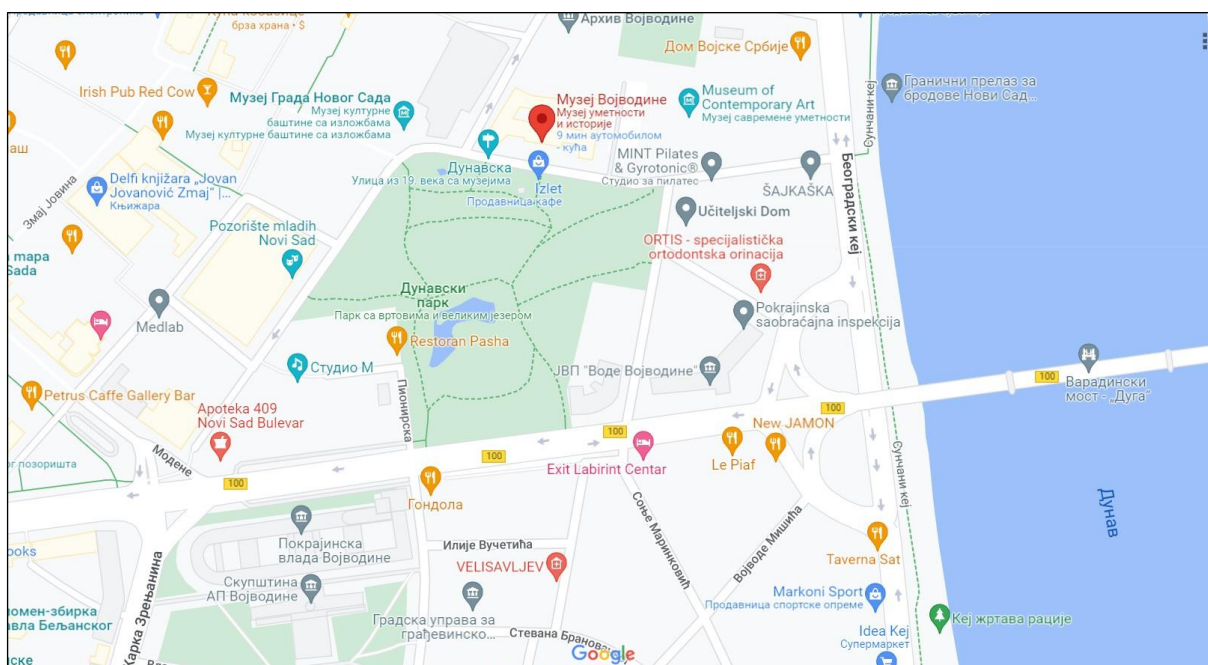
Pozorište mladih _____

Museum of Vojvodina _____

Danube _____

Provincial Government of Vojvodina _____

Task 2. With the help of a city plan, determine the sides of the world and check if it coincides with what was determined with the help of a compass. On the given map, enter the direction of the north and mark the listed objects from the first task.



Task 3. Based on the instructions you received from the teacher, independently determine the sides of the world at different locations in the park using the sun, clock and shadow. Write your observations here.

Task 4. After the teacher's explanation, find moss, a tree with a pronounced canopy or an anthill and determine the sides of the world. Take photos. Write down what you found and your observations here.

Task 5. Find three interesting plants and photograph them. Print the photos and insert them into the space provided. Enter the required information, and the name in Latin. On the plan of the park, mark the locations where you painted the plants. Write 1, 2 and 3 in red.



Herbarium paper

Name of plant _____

Date of harvest _____

Habitat _____

Name and surname of students _____



Herbarium paper

Name of plant _____

Date of harvest _____

Habitat _____

Name and surname of students _____



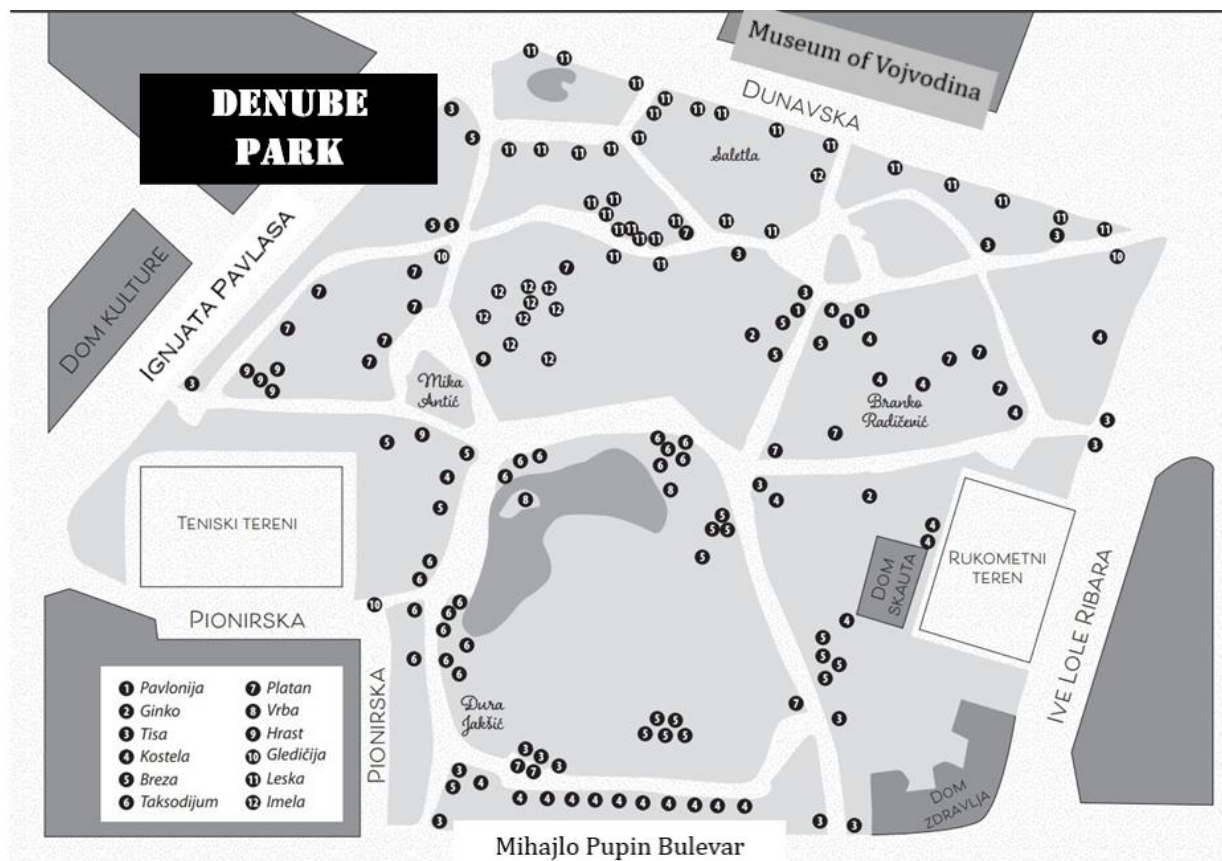
Herbarium paper

Name of plant _____

Date of harvest _____

Habitat _____

Name and surname of students _____



Activity 3 – Culture through the lens

Theme	Culture through the lens
Topic (Incorporation by curriculum)	Getting to know local geography of local environment; Historical development of the settlement
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	1 hour in the classroom + 1 hour in the field
Cross-curricular links	History, Informatics, Geoinformatics, History, Ethnology
Organizational forms	Group
Staffing	Geography teacher, one class

Teaching aids	Worksheet, smart phone, pen and notebook.
Place of realisation	The tasks were done on the example of Novi Sad, the old town (applicable in other cities as well). The task can be applied in other parts of the city, with the correction of coordinates and objects that want to be studied.
Environment's specifics	

Required entry knowledge and skills of students	Use of mobile phones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field about the cultural heritage of the local environment in which they live and where the school is located. 2. They also use applications that make it easier for them to navigate the space, and get to know the cultural heritage and material assets of the local environment. 3. Students get acquainted with the historic development of the observed settlement. 4. They study how much economic and urban development have contributed to the change of the old city core and whether these changes have had a positive or negative impact on the city and life in the city. 5. Students expand their knowledge in the field of geography of the local environment
Theoretical basis	The local environment should represent an area that is smaller than the region. It should be a landscaped entity or a space in which someone lives or a space in which essential life needs are met (housing, business). In addition, to the names local environment, hometown and homeland, there are also the names narrow homeland, wider homeland, local social environment. The term wider homeland means the fatherland. Some extend the narrow homeland to the borders of the district, and some consider that the term local environment can be identified with the commune (Lukić et al, 2012).
Conclusion (evaluation)	After the lesson in nature, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.

Individual approach suggestions	Talented student	Less-gifted student
---------------------------------	------------------	---------------------

	Individual work	Inclusion of students in a better (advanced) group
	They will have the task to make a Padlet on which all students will place their pictures and observations.	

Activity scenario	Teacher activities	Students' activities
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
Task 1	The teacher points out the use of GPS and the Lens application, which is necessary for the realization of the task, and takes the students to the city center.	Based on geographical coordinates or QR codes, with the help of a smartphone, they search for a given locality and cultural property in that area.
Task 2	The teacher goes to one location with the students and uses a practical example to show the students how to scan a certain cultural property with the Lens application.	Based on the teacher's presentation, the students try to repeat the work and then photograph the cultural goods and record basic information about them on the worksheet.
Task 3	The teacher shows an old photograph of the next cultural property at that location.	Students recognize the object, scan it with the application and record the information obtained, and then photograph the object.
Task 4	The teacher directs the students to the next locality and cultural property that they need to find using a guessing game.	Students recognize which object it is and use the Objectiv application to scan the marked cultural property at this location.
Task 5	He explains how the transformation of the space occurred due to the development of the city and draws the students' attention to what used to be in that place.	Students explore and comment on the changed space.
	Possible correction of the results of assignments in class. Upload photos and data to Padlet.	The students present in class the photographs and interesting things they made notes about on Padlet, presenting the results of the research they came across while working in the field.
Implementation risks		Weather conditions, Internet connection
Note:		

Key to the worksheet:

CULTURE THROUGH THE LENS

Task 1

Based on geographic coordinates or QR code, using your smartphone, try to find the first location by using Google Maps. Write the name of the location on the line.



45.254998572369004 N,
19.845277885411868 E

Task 2

Using Google Lens app (downloaded from the Google Play Store), scan the three listed cultural assets and find the additional information about them. Then take photos of them.

Cultural assets	Year of construction	Architect or sculptor	Interesting fact
Name of Mary Church			
The City House			
Svetozar Miletić monument			

Task 3

Based on the old photo, identify the object, and write down the required data after scanning with the Google Lens app. After writing the notes, take photos of the cultural property.



Answer the following questions about the location:

- I) What is the name of the cultural asset? _____
- II) By whom the cultural asset was named after? _____
- III) What was the year of its construction? _____
- IV) What kind of changes this cultural asset suffered?

- V) When comparing the old photos and the appearance of the object at this moment, what kind of changes can be noticed near it? Other objects? Transportation? Vegetation? _____

- VI) An additional task for the advanced level of knowledge!
In this location find the first tactile map (Braille Alphabet) that was set up in Novi Sad and explain the importance of its establishment in this place.

Task 4

Based on geographic coordinates or QR code, using your smartphone, try to find the location by using Google Maps and take a walk to it. Write down the name of the location.



45°15'12.1"N 19°50'36.7"E

Answer the following question about the location.

I) What way did you pass through from the first to the second location?

II) Try to find the object by playing the Guesser game (by asking simple questions in order to discover the name of the object). Write down the name of the object.

Task 5

Look at an old photo of this site and take a photo of it yourself. After that, compare and write down changes that occurred.





Answer the additional questions about the location.

- I) What was situated in this location in the past? _____
- II) When was the object teared down and which part of it still exists?

- III) What is the name of the object which is situated in this place today?

- IV) Write down five sentences about the people who were historically related to this location.

Task 6
What's your opinion about the transformation of this location?

Activity 4 – Urban climate

Theme	Urban climate
Topic (Incorporation by curriculum)	Climate; Climatic factors; Climatic elements; Climate types; Climate of the local environment
Target group	ISCED2 (age 14-15), ISCED3 (age 15-16)
Duration (outdoor, indoor part)	2 hours in the classroom + 2 hours in the field
Cross-curricular links	Geography, Biology, History, Serbian language
Organizational forms	Work in groups
Staffing	Geography teacher and one class

Teaching aids	Worksheet, Air temperature measuring instrument, pen and notebook.
Place of realisation Environment's specifics	The tasks were done on the example of Novi Sad (applicable in other cities as well). Students themselves choose 4 specific locations where the measurement will be performed (location with medium-height buildings; civil engineering near the river; civil engineering; an area that is less frequently built).

Required entry knowledge and skills of students	Proper use of air temperature measuring instruments.
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field when and how air temperatures are measured; how buildings of different heights, proximity to rivers and green areas affect air temperatures in cities. 2. They use an instrument which is normally used to measure air temperature; 3. Students get better acquainted with the parts of the city in which they live. 4. They recognize the problems that can be caused by excessive urbanization in cities. 5. Students expand their knowledge in the field of local climate, with special emphasis on the climate of cities.
Theoretical basis	In the second half of the twenty century urbanization reached significant level in the world. Because of that, half of the world population is under negative influence of urban environment, such as: pollution, noise, stress as a consequence of life style, modified parameters of urban climate, etc. Not only the large cities but also the smaller ones modify materials, structure, and energy balance of the surface and almost all properties of the urban atmospheric environment compared to the natural surroundings. Thus, owing to the artificial factors, a local climate (urban climate) develops, which means a modification to the pre-urban situation. This climate is a result of the construction of buildings, as well as of the emission of heat, moisture and pollution related to human activities (Unger et al, 2011; Savić et al, 2013).
Conclusion (evaluation)	After the outdoor activity, the students discuss the results they have reached, and possibly correct the conclusions they have reached.

Individual approach suggestions	Talented student	Less-gifted student
	Select multiple locations	Inclusion of students in a stronger group
	Writing an essay on a given topic	Additional clarifications on the climate of the local environment

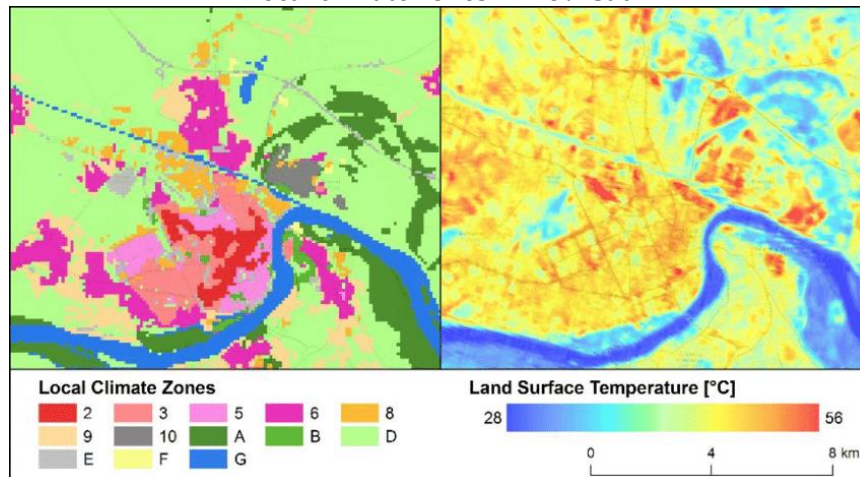
Activity scenario	Teacher activities	Students' activities
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
task 1	The teacher introduces students to the concept of urbanization and explains how it can affect the climate of a particular area.	They investigate how the construction of buildings, vegetation (city parks), water (rivers, lakes) affect the climate in cities.
task 2	The teacher and the students correctly choose the locations where the air temperature will be measured.	Students find 4 different locations in the city where they will measure the air temperature: compact midrise, compact low-rise near river, open low-rise and sparsely built.
task 3	The teacher shows how to use an instrument to measure air temperature.	Air temperature measurement at 4 selected locations at 9:00, 13:00 and 20:00. Entering values in the table.
task 4	Discussion with students.	After the measurement, in the next class at school, students compare data and discuss how buildings affect air temperatures in the city. They answer questions about whether the proximity of the river affects the air temperature in the city and suggest ways in which the air temperature in the city can be more pleasant.
	Possible correction of the results of assignments in class.	Students present the results of research that they came across while working in the field.
Implementation risks		Lack of measuring instruments; Inadequate site selection.
Note:		

Key to the worksheet:

URBAN CLIMATE

In the second half of the twenty century urbanization reached significant level in the world. Because of that, half of the world population is under negative influence of urban environment, such as: pollution, noise, stress as a consequence of life style, modified parameters of urban climate, etc. Not only the large cities but also the smaller ones modify materials, structure, and energy balance of the surface and almost all properties of the urban atmospheric environment compared to the natural surroundings. Thus, owing to the artificial factors, a local climate (urban climate) develops, which means a modification to the pre-urban situation. This climate is a result of the construction of buildings, as well as of the emission of heat, moisture and pollution related to human activities (Unger et al, 2011; Savić et al, 2013).

Local climate zones in Novi Sad

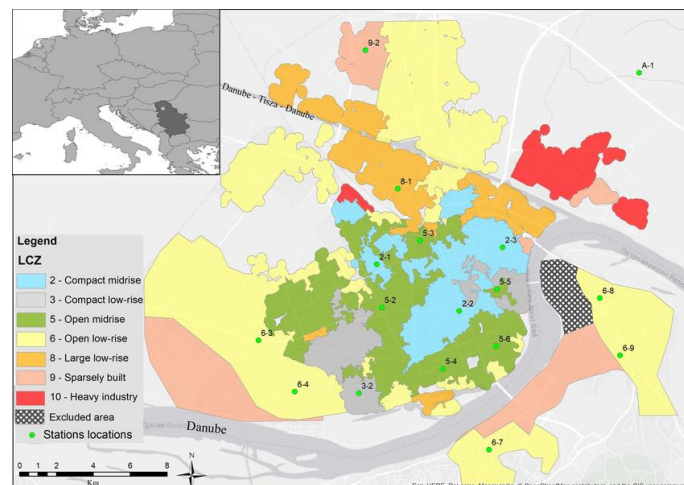


Savić et al., 2020

Task 1

Investigate how the construction of buildings, vegetation (city parks), water (rivers, lakes) influence the climate in the cities.

Spatial patterns of the local climate zones (LCZs) and the Novi Sad Urban Network (NSUNET) station sites in the built-up and land cover areas



Šećerov et al, 2019

Task 2

Find 4 different locations in the city where you will measure the air temperature.

1. Location with compact midrise - _____
2. Location with compact low-rise near river - _____

3. Location with open low-rise - _____
4. Location with sparsely built - _____

Task3

Visit selected location and measure the air temperature (9am, 1pm, 8pm) and write the temperature values in the table.

Location	9am	1pm	8pm
Compact midrise			
Compact low-rise near river			
Open low-rise			
Sparsely built			

Task 4

- Compare that data and try to figure out how construction affects the air temperature in the city.
- Does the nearness of the river affect the temperature in the city?
- Suggest a solution in which ways to make the temperature more pleasant in the city.

Write down your obseravtions.

Activity 5 – Biogeographer

Theme	Biogeographer
Topic (Incorporation by curriculum)	Flora and fauna of the local environment; Flora and fauna of the continents; Protected plant and animal species.
Target group	ISCED2 (age 13-14), ISCED3 (age 15-16)
Duration (outdoor, indoor part)	1 hour in the classroom + 1 hour in the field
Cross-curricular links	Geography, Biology, Informatics
Organizational forms	Work in groups
Staffing	Geography and biology teacher and one class

Teaching aids	Worksheet, smartphone, pen and notebook.
Place of realisation	Tasks can be applied in any park or larger green area around the school.
Environment's specifics	It is necessary to be able to find different plant species, as well as insects and birds, in the area where the field classes will take place.

Required entry knowledge and skills of students	Use of smartphones; previous knowledge in the field of plant and animal species, as well as their origin.
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the basic biogeographical characteristics of the space in their environment and identify certain plant and animal species; 2. They try to identify species that do not originate from the space around them and try to conclude where a particular plant or animal species are widespread; 3. They point out in what ecosystem certain species live and what are the living conditions (eg climate); 4. They point out which of the species are endangered, what are the reasons for that and how to influence it not to happen or decrease; 5. They use the iNaturalist application, through which they post photos of the required plant and animal species, recognize a certain species, answer the teacher's questions and receive feedback on the success of the task. 6. Students independently research and present their conclusions. 7. Students expand their knowledge in the field of geography and biology, especially in the content related to flora and fauna of the local environment and beyond.
Theoretical basis	<p>With the rapid changes our planet is undergoing, biogeography plays a key role in addressing real-world issues such as species distribution change. Environmental education in schools is seen as an important strategy in achieving environmental protection. One of the major goals in education is to prepare young children for the future (Morales-Ramirez & Wang, 2022; Šorytė & Pakalniškienė 2019). In the Republic of Serbia, a total of 860 wild species of plants, animals and fungi have the status of protected species, of which 253 species are animals (30 species of mammals, 35 species of birds, two species of reptiles, three species of amphibians, 29 species of fish and 154 species of invertebrates), 37 species of fungi and lichens and 570 species of plants (https://www.zzps.rs/wp/strogo-zasticene-biodiv/?script=lat).</p>

Conclusion (evaluation)	After the lesson in nature, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.
-------------------------	---

Individual approach suggestions	Talented student	Less-gifted student
	Individual work	
	They will have the task to choose one of the plant or animal species and prepare a short presentation about it and present it in front of the class. The presentation will contain information on the origin of a certain species, distribution, conditions for their survival, migration, forms of endangerment, possible proposals for solutions to a certain problem of the species, etc.	Inclusion of students in a stronger group

Activity scenario	Teacher activities	Students 'activities
Preparation in the classroom	Distribution of worksheets to students, introduction to fieldwork, introducing students to the tasks that await them. Repetition of material related to flora and fauna. Highlighting endangered or rare species in the field of research and the like. Answering the questions.	Students listen and ask questions if something is not clear to them.
	Teachers point out the application that is necessary for the realization of the task. Teachers create a Project on the iNaturalist application with the name of the class or the name that students choose. Teachers divides the students into groups and gives each group the task to find and take pictures of two types. The first group should find two different plant species, the second group two insect species and the third group two bird species. * Tasks may be different and adapted to the space in which fieldwork is conducted	Students listen carefully to the teachers and follow their instructions. All students create a profile on the mentioned application and join the formed group. They divide into groups and write down their tasks.
task 1	Teachers go with the students to the location where the field work will be realized and repeat the tasks once again. They monitor on the application whether the students post the required photos and whether they have written the correct names of the required types. The application approves the task with	Based on the teacher's instructions, students start working in groups and find the types they were given as a task. They take photos of the species and upload the photo to the iNaturalist app. They also complete the first task in the worksheet.

	(Agree) if it is completed correctly or does not approve and asks to repeat the task.	
task 2	Teachers monitor the work of students in the field, and help them, if necessary.	Students answer questions in the worksheet regarding the origin and distribution of a particular species. They mark the area on the map where the species is spread (each species with a different colour or symbol of their choice).
task 3	Teachers continue to monitor the work of students in the field. They guide them on how to properly answer the questions asked in the worksheet.	Students explore more of the plant and animal species that are in their tasks and answer the questions in the worksheet.
	Possible correction of the results of assignments in class.	Students present the results of research they came across while working in the field.
Implementation risks		Weather conditons; Internet connection
Note:		

Key to the worksheet:

BIOGEOGRAPHER

Task 1.

Find the required plant and animal species, take a picture of them and place the photo on the formed group on the iNaturalist application. Enter the name of this species on the application. QR code for iNaturalist:



Write what species you found:

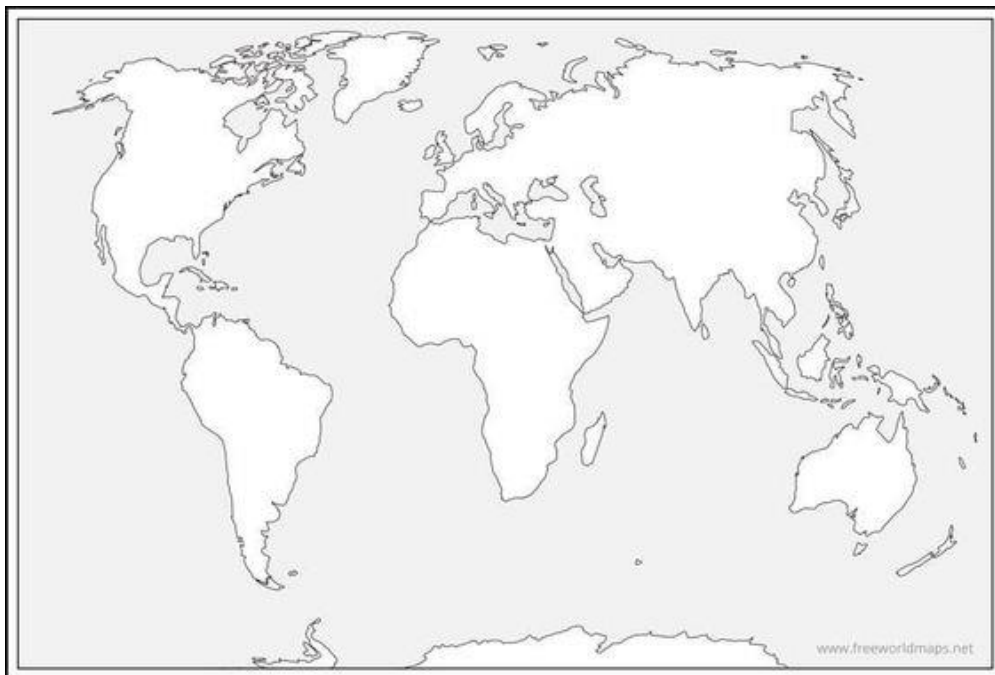
1. _____
2. _____

Task 2

For each of the listed species, write where it comes from. Is it a species that is autochthonous? Where is all this species widespread?

Species 1.

Species 2.



Task3

Based on the basic characteristics of the species and their distribution, try to conclude in what conditions they live (relief, climate, etc.). Is any of the species protected, endangered or threatened with extinction? Has man or any human activity influenced these species? Suggest

possible solutions to these problems.

Species 1.

Species 2.

Activity 6 - Hydroclimatologist

Theme	Hydroclimatologist
Topic (Incorporation by curriculum)	Inland waters; Rivers; River regime; Climatic elements
Target group	ISCED3 (age 15-16)
Duration (outdoor, indoor part)	1 hour in the classroom + 1 hour in the field
Cross-curricular links	Geoinformatics
Organizational forms	Work in groups
Staffing	Geography teacher and one class

Teaching aids	Worksheet, smartphone, thermometer and hygrometer, pen and notebook.
Place of realisation	The tasks were done on the example of Novi Sad (they are also applicable in other cities with minor corrections)
Environment's specifics	One location on the Danube River was chosen, where appropriate measurements should be made.

Required entry knowledge and skills of students	Use of smartphones; Use of smartphones; knowledge of managing instruments for measuring temperature (thermometer) and humidity (hygrometer).
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the basic hydrological features of the river or other hydrological object in the area; 2. Students get to know to the characteristics of the local environment in which they live. They look at the interrelationships between climate elements and water regime; 3. Students use applications that make it easier for them to navigate in space and increase digital competencies; 4. Independently research and conclude on the basis of data that they have to find out on the Internet and draw the required conclusions from them; 5. Students work with instruments for measuring temperature and humidity, which increases their skills; 6. They try to draw conclusions from the obtained research results and repeat the research over a period of time, in order to confirm the obtained results, renew knowledge and contribute to the permanence of knowledge. 7. Students expand their knowledge in the field of physical geography, especially in content related to river regimes and climatic elements.
Theoretical basis	The climate of the Vojvodina Region is controlled by the geographical position in the southern part of the Pannonian Basin. According to the Köppen climate classification it is moderately continental due to the weaker impact of western air currents, and the greater impact of a Eurasian continental climate. Climate is influenced by NW cold and humid wind, and the warm and dry SE wind. Hence, the main characteristic of the rainfall regime in Vojvodina is reflected in the pronounced variability in both space and time. The average annual precipitation is 606 mm, with the highest amounts in June, and lowest in February (Lukić et al, 2021).

	Vojvodina is rich in surface (rivers, lakes, ponds, canals) and underground (phreatic, artesian, thermomineral) waters. The larger navigable rivers include the Danube, Tisa and Sava, and the smaller: Stari Begej, Tamiš, Karaš, Krivaja, Bosut and others.
Conclusion (evaluation)	After the lesson in nature, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.

Individual approach suggestions	Talented student	Less-gifted student
	Individual work	Inclusion of students in a stronger group
	They will have the task to choose, in addition to the given location, several other locations where they will perform the required measurements and draw conclusions based on them. Also, the measurements will be repeated once in each season.	

Activity scenario	Teacher activities	Students 'activities
	Distribution of worksheets to students, introduction to fieldwork, introduction of students to work on instruments for measuring temperature and humidity. Answering any questions.	Students listen and ask questions if something is not clear to them.
task 1	The teacher points out the application that is necessary for the realization of the task. The teacher goes to the location with the students and in a conversation with the students points out the basic hydrological characteristics of the hydrological object (river) where the selected location is located. Teacher then asks the students to observe the river.	Based on geographical coordinates or QR code, with the help of a smartphone, students find the required location. Students, together with the teacher, based on the acquired knowledge, teacher's questions and direct observation, try to conclude what are the basic hydrological characteristics of the hydrological object (river) where the required location is located.
task 2	The teacher asks the students to find the data related to the water level of the river at the nearest water meter station on the official website. In the example, the water meter station is Novi Sad on the Danube. * Do this task in class before going to the field.	Based on the data found by the students, they conclude more about the river regime of the river on which the requested location is located and write their observations in the worksheet.

task 3	<p>The teacher repeats to the students how to use the appropriate instruments correctly and how to read the required values. It helps students who need additional clarification.</p> <p>* In case of lack of instruments, it is possible to use smartphones, but in that case, you should be aware that the obtained results will not be accurate.</p>	With the help of appropriate instruments, students measure the temperature and humidity of the air and record the obtained values in a worksheet.
task 4	Explains to students which elements to pay attention to when drawing conclusions about the river regime. It leads students to draw the required conclusions on the basis of data from the Internet and measured values on the site.	They research, analyze measured values, draw conclusions and record everything in a worksheet.
task 5 (Bonus task)	The teacher gives an additional task to students who show more interest in the topic being covered. It asks students to repeat their measurements during each season at the same location (or optionally at several other locations of the same hydrological object) and based on that raise the research to a higher level.	Students repeat the measurements at the same location (or more of their choice) during each season and, based on the obtained results, draw conclusions about the water regime of the selected hydrological object.
	Possible correction of the results of assignments in class.	Students present the results of research they came across while working in the field.
Implementation risks		Weather conditons; Internet connection
Note:		

Key to the worksheet:

HYDROCLIMATOLOGIST

Task 1.

Find this place on site by using following coordinates 46°33'22.6"N 15°38'54.3"E or scan QR code



45.252759, 19.855861
(45°15'09.9"N 19°51'21.1"E) _____

Just observe the water level on a location from this photo.

Task 2.

Try to find on the Internet the measured value of water level that is measured on the nearest station.

Additional help: <https://www.hidmet.gov.rs/>

Write down your observations.

* Do this task in class before going to the field.

Task 3.

Measure the temperature and air humidity on the same location by using appropriate instruments (thermometer and hygrometer) or by using mobile phone application.

Temperature _____ Air humidity _____

Task 4.

Try to draw a brief conclusion about the water regime of the Danube near Novi Sad based on the water level data you found on the Internet, direct observations and measured values in the field.

Task 5. (BONUS TASK)

Repeat the measurements at the same location during each season and note the changes. You can take measurements at several locations on the same river and compare the results. Make a note of your conclusions.

Activity 7 – My city through VR

Theme	My city through VR
Topic (Incorporation by curriculum)	Getting to know local geography of local environment; Historical development of the settlement, Cultural heritage of Serbia, Structure and expansion of urban spaces, Polarization of settlement development, Culture of memory, Technical and digital literacy
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	1 hour in the classroom + 1 hour in the field
Cross-curricular links	Urbanisation, Spatial planning, Geoinformatics
Organizational forms	Group work, Geography teacher and Technology teacher, one class

Teaching aids	Worksheet, smart phone, VR glasses, pen and notebook.
Place of realisation	The tasks were done on the example of Novi Sad, the river bank space, two squares in the old town centre (applicable in other cities as well with minor changes).
Environment's specifics	

Required entry knowledge and skills of students	Use of mobile phones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the peculiarities of the local environment in which they live and where the school is located, using modern technical achievements. 2. They use VR glasses, which makes it easier for them to get acquainted with familiar and unfamiliar spaces in a different way. 3. Students get acquainted with the historic development of the observed settlement and the polarization of the settlement as a direct consequence of the development. 4. They study how much the given locations have affected and how much they affect the environment today. 5. Students expand their knowledge of the local environment and the use of modern technology, which increases their digital literacy.
Theoretical basis	<p>Today's generations of students are growing up in a media environment where the use of computers, mobile devices and the Internet is part of everyday life. The term virtual reality (VR) originated in the 1960s and there are two types, immersive and non-immersive virtual reality. Non-immersive virtual reality is based on a computer-generated three-dimensional environment that simulates real places or imaginary worlds and for whose approach a computer is sufficient. Immersive (or complete) virtual reality creates the perception of presence in a simulated environment and requires the use of additional devices, most often special glasses (HMD) with controllers. Virtual education can be defined as the process of acquiring knowledge, skills and habits in a computer-generated, simulated, visually three-dimensional, auditory and tactile environment in accordance with user behavior. Virtual reality is used in the literature to describe various technologies such as: simulators (for example flight, surgical and similar), virtual worlds, massive multiplayer online game (MMOG), simulations, CAVE systems (Cave</p>

	Automatic Virtual Environment) and different types of glasses/helmets, i.e. HMD devices for virtual or mixed reality (Stojšić, 2019; Jensen, Konradsen, 2018).
Conclusion (evaluation)	After the lesson in nature, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.

Individual approach suggestions	Talented student	Less-gifted student
	Individual work	Inclusion of students in a better (advanced) group
	They will have the task to make a video in which they will insert their recordings.	

Activity scenario	Aktivnosti nastavnika	Aktivnosti učenika
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
Task 1	The teacher points out the existence of 360 ° videos on Youtube that can be used and explains the use of VR glasses, which are necessary for the realization of the task.	Based on geographical coordinates or QR codes, with the help of a smartphone, they search for the first given location.
Task 2	The teacher goes to the given location with the students and explains what was in that place in the past, how the construction affected the development of urbanization in this part of the city and how it affects the environment today.	Students use VR glasses to watch a video from the past, then use a smartphone to record their video (panorama) or make a full 360 ° video. They note in the notebook what they noticed as a difference on the spot. After the first location, the second and third are found, and then it is researched: what this environment looked like in the past, how urbanization took place, whether development flows were degrading or improving and whether the environment is endangered.
Task 3	The teacher goes with the students to another location and the game of associations leads them to what to pay attention to.	After recognizing the location, the students go to the same place with the teacher, they recognize the new object. They repeat the action of observing the video through VR glasses, find old photos of this locality and make their own video.
Task 4	The teacher directs the students to the next location and leads them to decide which object they should concentrate on.	Students use VR glasses to review the footage from the earlier period, look for old photographs and make their own footage. They conclude what differences arose on the field, and record everything

		in a notebook.
Task 5	He explains how to develop the development of settlements, especially cities such as Novi Sad, and as a result of which there is a change in the physiognomy of the settlement.	They research and give suggestions on how to improve the environment in the given locations, which have been changed due to the polarization of the settlement.
	Possible correction of the results of assignments in class.	The students present the prepared presentations from the field in class, presenting the results of the research they came across while working in the field.
Implementation risks		Weather conditions, Internet connection
Note:		

Key to the worksheet:

MY CITY THROUGH VR

The term virtual reality (VR) originated in the 1960s and there are two types, immersive and non-immersive virtual reality. Non-immersive virtual reality is based on a computer-generated three-dimensional environment that simulates real places or imaginary worlds and for whose approach a computer is sufficient. Immersive (or complete) virtual reality creates the perception of presence in a simulated environment and requires the use of additional devices, most often special glasses (HMD) with controllers. Virtual education can be defined as the process of acquiring knowledge, skills and habits in a computer-generated, simulated, visually three-dimensional, auditory and tactile environment in accordance with user behavior.

Task 1

Based on geographic coordinates or QR code, using your smartphone, try to find the locations by using Google Maps. Write the name of the location on the line.



(45°25'31"N 19°85'58"E)

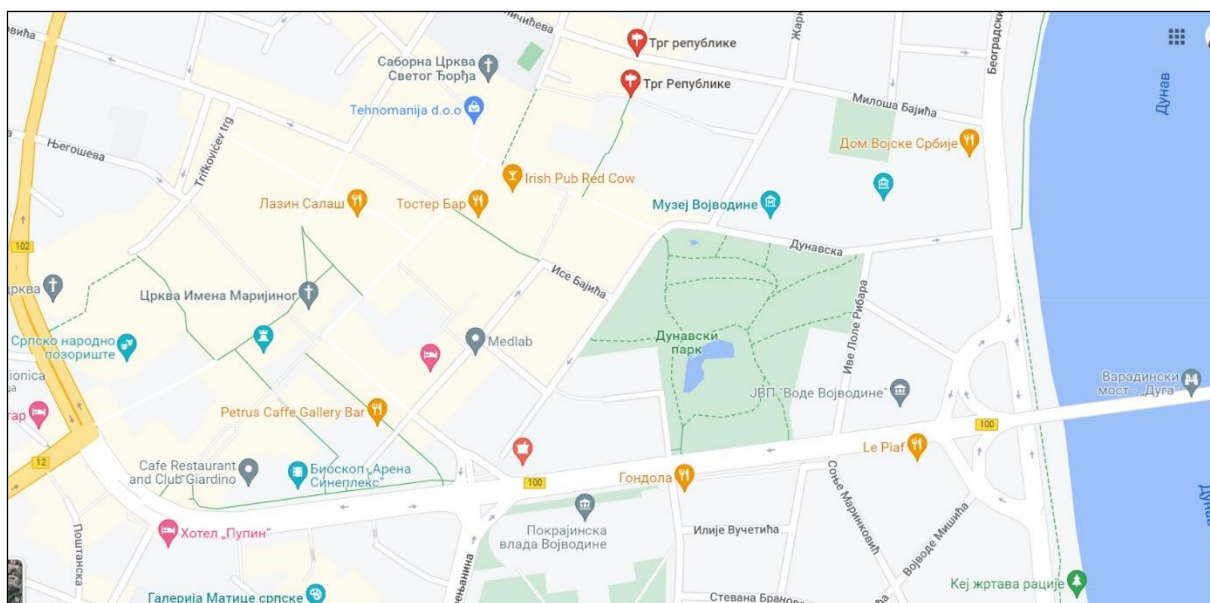


(45°25'77"N 19°84'91"E)



(45°25'53"N 19°84'30"E)

Mark first location on the city map by using red colour, second by using blue colour and the third one by using green colour.



Task 2

Watch the following video by using VR glasses. Pay your attention to the first 2 minutes and 30 seconds.

<https://www.youtube.com/watch?v=SYImOa1811k>



Look at the old photos of Novi Sad and try to recognise this location on the photos.

https://www.youtube.com/watch?v=vXK_X_xjGk



Fill the following table.

LOCATION	What was in this location in the past?	What had been changed in this location?	What is the influence of this location on the city environment?

Task 3

Watch the following video by using VR glasses. Pay your attention to 2.54 min

https://www.youtube.com/watch?v=EXp_aSVWSlo&t=168s



Look at the old photo of this location, and after that, try to compare the video, old photo and the appearance of the location at this moment.



Fill the following table.

LOCATION	What was in this location in the past?	What had been changed in this location?	What is the influence of this location on the city environment?

Task 4

Watch the following video by using VR glasses. Pay your attention to 4.25 min

https://www.youtube.com/watch?v=D-h_LfD5oPE



Look at the old photos of this location, and after that, try to compare the video, old photo and the appearance of the location at this moment.



Fill the following table.

LOCATION	What was in this location in the past?	What had been changed in this location?	What is the influence of this location on the city environment?

Task 5

Since you have visited the listed locations, write down your observations about them (how the settlement was polarized, how the changes affected the environment, what would you do if you could make changes in those locations...?). Make a PowerPoint presentation to present the locations and changes that have been occurred.

Activity 8 – Learning geography and flying

Theme	Learning geography and flying
Topic (incorporation by curriculum)	Getting to know the local environment; Historical development of settlements, Structure and expansion of urban spaces, Polarization of development of settlements, Culture of memory, Technical and digital literacy
Target group	ISCED3 (age 17-18)
Duration (outdoor, indoor part)	2 hours in the field + 2 hours in the classroom
Cross-curricular links	Geography, History, Technique and technology, Geoinformatics
Organizational forms	Work in groups
Staffing	Teacher of geography, teacher of technique and technology, one class

Teaching aids	Worksheet, smartphone, drone, pen and notebook
Place of realisation Environment's specifics	Tasks were done on the example of Novi Sad (applicable in other cities with minor corrections) It is the part of the city where the University campus is located. The task can be applied in other parts of the city, with the correction of coordinates and objects that want to be studied.

Required entry knowledge and skills of students	Using smartphones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students meet with the peculiarities of the local environment in which they live through teamwork in the field. 2. They use drones and applications that will make it easier for them to navigate in space. 3. They study how much the given locations have affected and how much they affect the environment today, and how they have changed over time. 4. Students expand their knowledge in the field of local environment
Theoretical basis	Geographical research requires the ability to collect, present and interpret spatial data. During the last decades, the quality and availability of satellite imagery and aerial photography has increased rapidly and has become an important resource for learning and teaching geography. Although fieldwork remains an important part of research and data acquisition in recent decades, new "tools" have been developed to capture, record, and even measure geographic phenomena from the air (Casagrande, 2018). Unmanned air vehicles (UAV - Unmanned air vehicles), which are often used interchangeably with the term "drone" (Dynamic Remotely Operated Navigation Equipment), are aircraft that can fly autonomously. The use of drones in geography belongs to the science of remote sensing. Remote sensing is the science of obtaining information about objects or areas without making physical contact, usually by using aircraft or satellites (Ivkov Dzigurski et al, 2022).
Conclusion (evaluation)	After the outdoor classes, students should make a presentation where they will present the obtained results and conclusions from the field.

	Discussion and possible correction of results.
--	--

Suggestions of individual approach	Gifted students	Students below average
	Individual work They will have the task to make a presentation on a given topic.	Inclusion of students in a stronger group

Description of activities	Teacher activities	Student activities
	Introduction to field teaching, answering any questions. Division of worksheets.	Students listen and ask questions if something is not clear to them.
Task 1	He goes to the given location with the students. Indicates basic information about the drone and its basic functions. Instructs students to install the DJI GO 4 application on their smartphones, which they will need to work with the drone. The teacher explains how the drone takes off and how it is operated. Drone management training (up-down, forward-backward, left-right, turning around the drone axis to the left and right). Explains landing.	They determine the given location and go to the same place together with the teacher. They follow and write down what the teacher explains, noting the basic functions they need for further work. Based on the teacher's presentation, the students record the steps in launching the drone. After the demonstration of the teachers, they launch the drone individually. Landing practice.
Task 2	The teacher explains how to select shots during the drone flight and how to take photos.	Students recognize the shots and write in the worksheet which are the representative objects that are located at the given location, and then photograph them with a drone.
Task 3a	The teacher explains how to take a photo panel (frame width 180°; spherical panel).	Students record what the teacher explained, and then take a photo board on their own.
Task 3b	The teacher explains the shooting of quick shot videos (rocket mode, drone mode, helix mode, circle mode and boomerang mode).	Students explore the environment and make a video.
Task 4	He points out the changes that have taken place or are taking place in this area, emphasizing how much some of them affect the overall life of people in this part of the city.	They write down their observations about the location they visited and which they studied with the help of a drone. They conclude what changes have taken place in this area and how much they affect the environment.
Possible implementation risks		Possible correction of the results of assignments in class.

Note: weather conditions, Internet connection

Key to the worksheet:

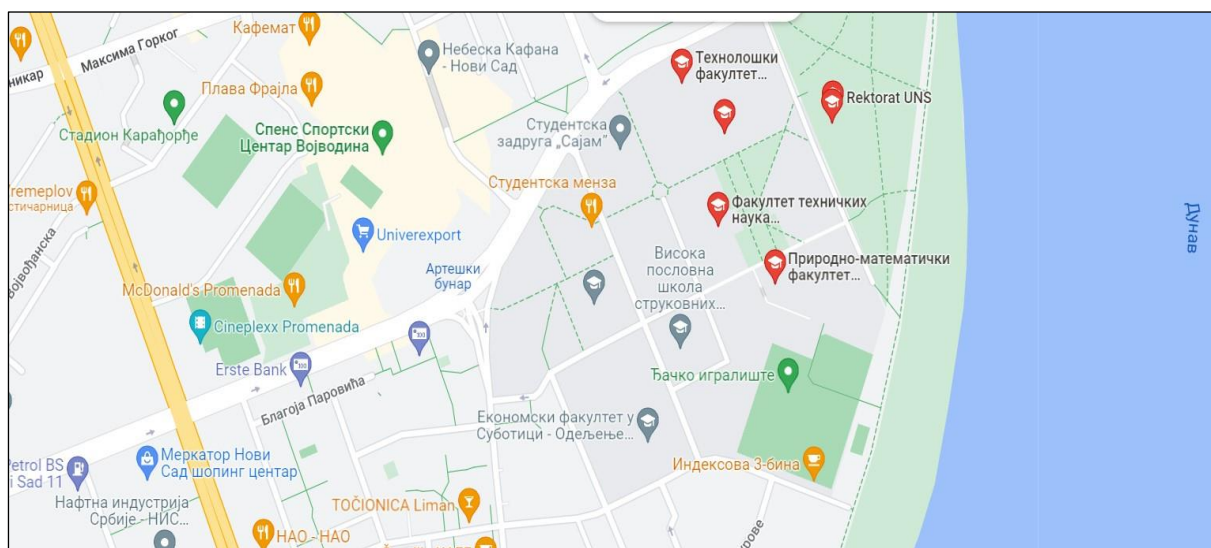
LEARNING GEOGRAPHY AND FLYING

Task 1. Based on QR code or coordinates, find a location to work.

45.244004 19.853017 _____ (insert location name)



Circle the given location on the map:



Task 2. On the map, see which are the representative objects in the area and on the basis of the attached photos to recognize them and write the name on the line below the picture. Use the drone to take your photos of the same.



Figure 1. _____



Figure 2. _____



Figure 3. _____

Task 3. Use a drone to take a photo board and record a video.

Task 4. Write your observations about the location. Do you notice that there are some changes that are happening (construction sites, etc.). How does it effect the environment in this part of Novi Sad? Are there enough green areas? Are there any unused spaces and what would you suggested to use? Is there enough parking space? Is there enough space intended for various free activities of people (relaxation and entertainment, sports and recreation ...)?

Activity 9 – Wine routes

Theme	Wine routes
Topic (Incorporation by curriculum)	Relief; Climatic elements; Climatic factors; Primary sector of the economy; Agricultural production
Target group	ISCED2 (age 14-15), ISCED3 (age 17-18)
Duration (outdoor, indoor part)	2 hours in the classroom + 1, hour in the field
Cross-curricular links	Geoinformatics, Hystory, Economical Geography
Organizational forms	Group work, Geography teacher and history teacher, one class

Teaching aids	Worksheet; smartphone; thermometer and hygrometer; pen and notebook.
Teaching aids Place of realisation	The tasks were done on the example of Sremski Karlovci (they are applicable in other cities with minor corrections)
Environment's specifics	One location in the part of Sremski Karlovci was chosen where appropriate measurements should be made.

Required entry knowledge and skills of students	Use of smartphones; knowledge of managing instruments for measuring temperature (thermometer) and humidity (hygrometer).
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the basic features of relief and climate that have influenced the production and quality of vines; 2. Students are introduced to the peculiarities of the local environment in which they live; 3. They get to know the interrelationships between relief, climatic elements and factors and agricultural production; 4. They get to know the interrelationships between content from geography, geoinformatics and history 5. They use applications that will make it easier for them to navigate in space and increase digital competencies; 6. Independently research and conclude on the basis of data that they have to find on the Internet and draw the required conclusions from them; 7. Students work with instruments for measuring temperature and humidity, which will increase their skills; 8. They try to draw conclusions from the obtained research results so as to contribute to the permanence of knowledge and interdisciplinary correlations. 9. Students expand their knowledge in the field of physical geography, social geography (primarily economic geography) and geography of the local environment. In particular, knowledge from the contents related to relief and its impact on human activities, climatic elements and factors, dependence of agricultural production on natural factors expand.

	10. Students connect the contents from geography with the contents from history.
Theoretical basis	<p>The Constantinople Wine Route is a new wine tourism project in the Balkans. The initiative comes from Serbia, and this route, in addition to Serbia, also connects Bulgaria and the European part of Turkey (Thrace). Wine tourism is a relatively new type of tourism in the Balkans. The existence of a wine route, based on a striking commonality the past, rich in cultural and historical heritage, similar, yet completely different gastronomy, viticulture that cultivates a completely different autochthonous assortment, but also completely different styles of wine of international and regional varieties, cultural, religious and ethnological diversity, can promote wine tourism in all three countries much easier. Moreover, it is a fact that clearly defined wine routes enrich the tourist product, create greater engagement of people in rural areas, extend the tourist season, accelerate economic development, facilitate promotion, raise the image, revitalize the village, etc.</p> <p>Today, the Fruška gora wine route can offer more than 60 family cellars where can be tried various types of this drink. Fertile Pannonian soil, centuries of experience in winemaking and mysterious recipes have made Sremske Karlovci the capital of wine (Maksimović et al, 2019; https://www.serbia.com/srpski/posetite-srbiju/provedi-se/vinski-putevi/vinski-put-fruska-gora/).</p>
Conclusion (evaluation)	After the outdoor classes, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of results.

Individual approach suggestions	Talented student	Less-gifted student
	Individual work	Inclusion of students in a stronger (advanced) group
	They will have the task to choose, in addition to the given location, several other locations where they will perform the required measurements and draw conclusions based on them. Students will have the task of observing each location through a historical prism.	

Activity scenario	Teacher activities	Students' activities
	Distribution of worksheets to students, introduction to fieldwork, introduction of students to work on instruments for measuring	Students listen and ask questions if something is not clear to them.

	temperature and humidity. Answering any questions.	
Task 1	<p>The teacher points out the application that is necessary for the realization of the task.</p> <p>The teacher goes to the location with the students and in a conversation with the students points out the basic characteristics of the relief and climate and leads the students to think about what the relief and climate can be related to agricultural production. The teacher instructs the students to observe the relief correctly in order to connect it with agricultural production.</p>	Students go to the given location together with the teacher and based on the acquired knowledge, teacher's questions and direct observation, they try to conclude what are the basic connections and mutual influences of natural factors on agricultural production.
Task 2	<p>The teacher asks the students to measure the air temperature and humidity at the given location using appropriate instruments or mobile phones. The teacher reminds the students to write down the measured values.</p> <p>* In case of lack of instruments, it is possible to use smartphones, but in that case you should be aware that the obtained results will not be accurate.</p>	Based on the data obtained by measuring, students draw initial conclusions about the features of relief and climate at the local level and assume the possible effects of the same on human activities.
Task 3	The teacher gives the students the task to find the data on the annual insolation for the given area with the help of smartphones and to write down the data. The teacher suggests to the students the sites from which it is most reliable to download the necessary data.	Students use smartphones to find the annual values of insolation and record the values in a worksheet.
Task 4	Explains to students which elements to pay attention to when drawing conclusions about the connection between relief, climatic characteristics and human activities (in this case wine production). It leads students to draw the required conclusions on the basis of data from the Internet and measured values on the site.	They research, analyze measured values, draw conclusions and record everything in a worksheet.
Task 5	The teacher gives an additional task to students who show more interest in the topic being covered, from the aspect of interdisciplinary correlation. He asks students to explore the history of the area and see the space through historical	Based on various historical sources and materials, students connect knowledge from geography with history, which provides interdisciplinary knowledge about the local environment. Students compile a report that contains elements from both subjects.

	development. Based on the above, to raise the research to a higher level and to write a short report on the history of the region.	
	Possible correction of the results of assignments in class.	The students present the prepared presentations from the field in class, presenting the results of the research they came across while working in the field.
Implementation risks	Weather conditions, Internet connection	
Note:		

Key to the worksheet:

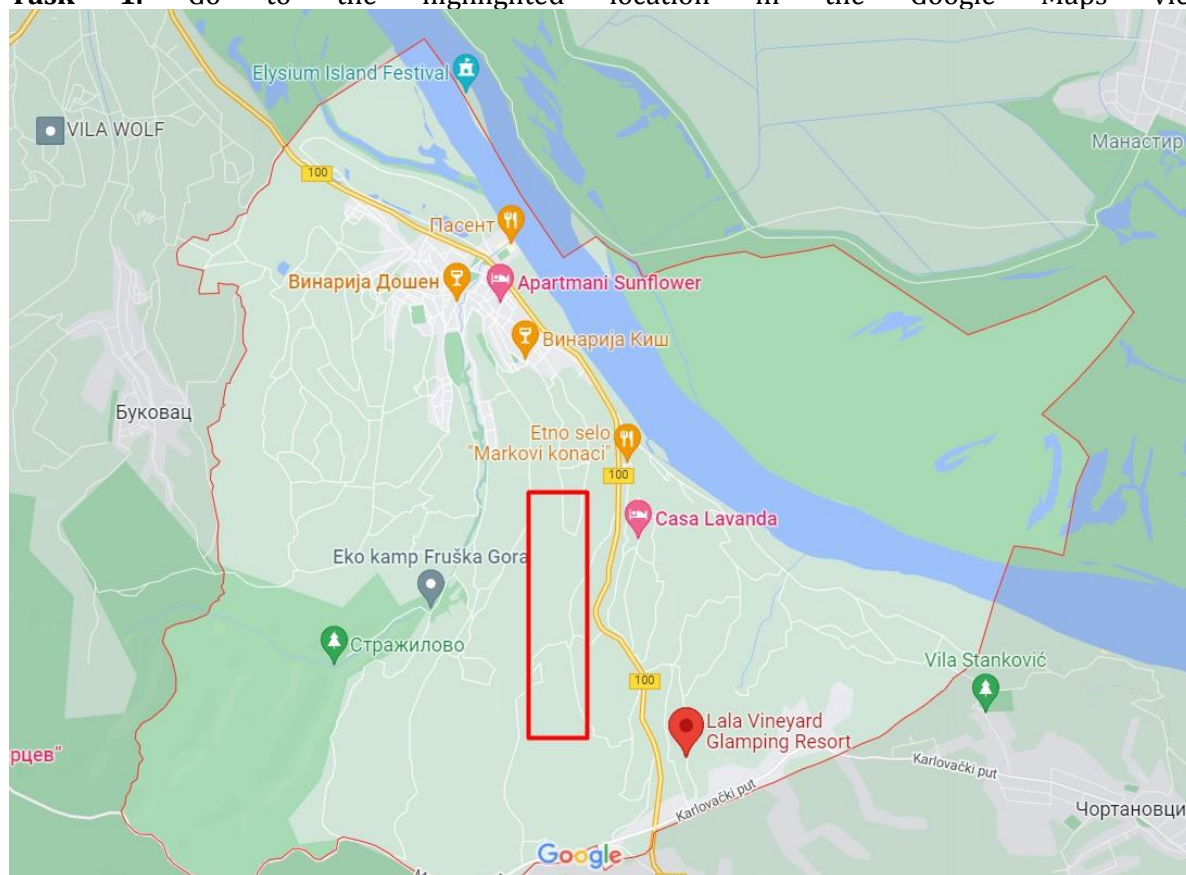
WINE ROUTES

Within the Fruška Gora vineyards, the Sremski Karlovci wineries, that is, the Sremski Karlovac micro vineyards, where good wine has been flowing for centuries, have been tucked away. What gives the local divine nectar a special charm is that it goes in combination with a fine patina, old castles, churches and other famous buildings, such as the seminary, metropolis, gymnasium, chapel of peace (next to which is Karlovac Peace Street, which everyone calls Wine). street), creating a combination of beautiful and valuable antiquity and youthful energy.

Wineries in Sremski Karlovci are grouped in two places in this sweet town - there are many around the center of Sremski Karlovci, where the main tourist attractions and the largest turnover of people, and many of them in the side streets. They were especially remembered in Švapska Street, which is also the main wine route in Sremski Karlovci. The Sremsko Karlovac region has been wine and viticultural for centuries, so it has become a modern center of wine tourism in that part of Vojvodina.

Karlovac wine was included on the wine lists of overseas ships from Europe to America, because many traders bought and exported this Karlovac nectar to the world. However, Karlovac wine was drunk not only on ships, but also at imperial courts, such as those in Vienna, and even in Moscow.

Task 1. Go to the highlighted location in the Google Maps view.



Task 2. Measure the air temperature and humidity using the appropriate instruments (thermometer and hygrometer) or do it with the help of a mobile phone.

Write down your observations.

—.

Task 3. Try to find the average insolation values for a given area on the Internet. Make a note of what you found. Additional help
https://www.hidmet.gov.rs/data/meteo_godisnjaci/Meteoroloski%20godisnjak%201%20-%20klimatoloski%20podaci%20-%202020.pdf

—.

Task 4.

Try to make a brief conclusion about natural factors (relief and climate) and their impact on wine production.

Task 5. Bonus task

Find additional information about the history of the area and write a short report on what you found.

Activity 10 – Back to the past

The theme	Back to the past
Topic (incorporation by curriculum)	Getting to know the local environment; Serbs in the Habsburg Monarchy
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	1 hour in the classroom + 2 hours in the field
Cross-curricular links	History, Art Culture, tourism
Organizational forms	Group
Staffing	Geography teacher, history teacher and one class

Teaching aids	Worksheet, notebook, pen, crayons, phones
Place of realisation Environment's specifics	The tasks were done for the Petrovaradin Fortress, but they are also applicable in other places that have similar fortifications. It can also be used to explore certain parts of the city with minor corrections. It is a space that is arranged and important in the tourist segment.

Required entry knowledge and skills of students	It is necessary for students to have prior knowledge of which peoples have moved in this area.
Objectives of the activity	<ol style="list-style-type: none"> 1. Students connect with the knowledge gained in school with what they directly have the opportunity to see in the field 2. Students expand their knowledge of history and geography, with special emphasis on the contents of social geography.
Theoretical basis	<p>Vojvodina is a province in the north of Serbia. It became its part after the World War I and the dissolution of the Austro-Hungarian Monarchy (1918). The concept of Vojvodina, i.e. of Serbian Vojvodina, first appeared on the May Assembly in Sremski Karlovci in 1848. By 1918 that concept evolved into ideological basis for uniting Southern Slavs. Since the territory of Vojvodina was in the extreme southern part of Austro-Hungarian Monarchy (Juzna Zemlja- Delvidek or in the north of the Ottoman Empire it often changed its ruler. Serbs made a big percent of the population after the Turks had left, especially in the part that belonged to the Military Boarder. On the other hand there were empty areas. The reasons for this were the geographical characteristics of the territory, since there were marshy grounds unsuitable for living. However, the Austro-Hungarian authorities started the colonization of the area. The colonization had an economical, political and national religious feature. Before the colonization the whole Banat (Yugoslavian and Romanian) had a population of approximately 20,000 people, and around 25,000 people lived in Backa. Numerous nations were settled by colonization. Some of them were settled to improve the economical</p>

	<p>situation on the territory, and some to break the economical homogeneity of orthodox people.</p> <p>During the last three centuries the today's territory of Vojvodina has had a role of classical immigration area so the ethnical situation in Vojvodina is very complex due to historical events. In a relatively small territory many different nations and national groups live there today, which is the consequence of migrations in the distant and recent past (Bubalo-Živković et al, 2014).</p>
Conclusion (evaluation)	<p>After the nature class, the students will make a presentation in which they will present the historical development of the fortress over time. This is followed by a discussion and corrections.</p>

Suggestions of individual approach	Gifted students	Students below average
	<p>Individual work</p> <p>The student will have the task to photograph everything that he considers important for the fortress in the field and then make a video in which he will show it all.</p>	<p>Inclusion of students in stronger groups.</p>

Description of activities	Teacher activities	Student activities
	<p>The teacher distributes worksheets. Explains the task and goal of a class in nature. Gives instructions on what students should bring. Teachers of history and geography repeat with the students the material that is necessary to know in order to go to field work (a lesson in nature).</p>	<p>They listen to the teacher, answer questions, ask questions if something is not clear enough to them.</p>
Task 1	<p>Going with the students to the field. The teachers explain the geographical position of the Petrovaradin Fortress and what existed in that place in the past and what names were used. They help students if needed.</p>	<p>With the help of the Internet, students discover the geographical coordinates and the origin of the name Petrovaradin Fortress.</p>
Task 2	<p>Teachers talk to students about the period when Austro-Hungary existed. They lead students to answer the task correctly.</p>	<p>Students, with the help of teachers and the Internet, discover when construction began and when the construction of the fortress was completed, which important people designed the fortress.</p>

Task 3	Teachers associate Gibraltar with the term "Gibraltar on the Danube" in order to lead students to the correct answer. They follow their further work.	Students connect previous knowledge with new. They use the internet and present their ideas to solve the task.
Task 4	Teachers talk to students about various events that are held in Novi Sad. They point them in the right direction.	With the help of the Internet, students discover which of the most famous events are held in Novi Sad, with a special focus on the Petrovaradin Fortress.
Task 5	Teachers talk to students about the lesson, about their observations. They guide students to notice the specificity of the lesson. They explain which were the most important people at that time so that the students could solve the task. Not only that, but they inform them that they should have a sketch.	Students see the specifics of the clock, explain their ideas why the clock looks like this. They use the internet to solve a task. They sketch the clock and the surrounding landscape.
Possible implementation risks		Internet connection, weather
Note:		

Key to the worksheet:

BACK TO THE PAST

1. Go to the Petrovaradin Fortress. Determine the geographical coordinates and state how the fortress got its name.

Geographical coordinates _____

The name Petrovaradin comes from words _____

2. Answer the following questions.

a) Indicate the year of the beginning of the construction of the fortress.

_____ b) Indicate the year when the construction of the fortress was completed.

_____ c) Give the name of the man who first presented the plan for the construction of the Petrovaradin Fortress.

_____ d) Which dynasty ruled Vojvodina at that time?

3. Explain why this fortress is historically known as "Gibraltar on the Danube".



4. Look at the picture and answer the questions.



1) Which famous international festival is held every year in July at the Petrovaradin Fortress?

2) Indicate the year when this festival was first held in Novi Sad.

5. Go to Petrovaradin Clock, and then answer the following tasks.

a) Complete the following sentence:
She gave this watch to the former Petrovaradin trench

(specify name)

That happened _____
(specify year)

- b) Explain why the large hour hand shows hours and the small hour hand shows minutes.

- c) Sketch the clock and present the surrounding landscape.

Activity 11 – Trails of culture

The theme	Trails of culture
Topic (incorporation by curriculum)	Landscape and manifestation tourist values; Artistic and ethnosocial tourist values; Anthropogenic tourist values.
Target group	Vocational high school (e.g. tourism technician) ISCED3 (17-18)
Duration (outdoor, indoor part)	One hour on the field + one hour in the classroom
Cross-curricular links	Art culture, history, literature, tourism
Organizational forms	Group
Staffing	Geography teacher and one class

Teaching aids	Smartphone, worksheet, pen, notebook
Place of realisation Environment's specifics	The tasks were done on the example of Novi Sad (applicable in other places, with site corrections). Parts of the city where the cultural stations of the city of Novi Sad are located.

Required entry knowledge and skills of students	Using smartphones
Objectives of the activity	1. Students learn through teamwork in the field with cultural stations in the city and to give suggestions to produce printed tourist guides 2. Students expand their knowledge in the field of landscape, manifestation, artistic, ethnosocial and anthropogeographic tourist values
Theoretical basis	Tourism as an economic activity is constantly developing and represents a leading branch in the world economy. Cultural tourism is one of the most important forms of tourism, given the diversity of cultural forms that are of interest to modern tourists. According to WTO estimates, in the publication "Tourism: 2020 Vision", it was predicted that the cultural tourism market will be one of the five leading segments of the tourism market in the future. By properly planning the construction of tourist infrastructure, protection of natural areas, education and constant monitoring, it is possible to largely control the further impact of tourism on the natural environment and its transformation into cultural tourism that is developmental, without a mass character and extremely suitable for multi-ethnic environments because the common interest in providing a tourist offer, it unites people of different ethnic structures (Hadzic 2007, Đorđević & Đorđević, 2017).
Conclusion (evaluation)	After nature classes, students should make suggestions for a printed tourist guide (PPT) based on the data collected in the field and should design programs for tourists that are based on the tradition, natural and cultural features of the area. Discussion and possible correction of the work.

Suggestions of individual approach	Gifted students	Students below average
	Individual work	Inclusion of students in a stronger group
	Site selection; Making a tourist guide and assembling the collected material into a meaningful whole, marketing shaping the whole product.	

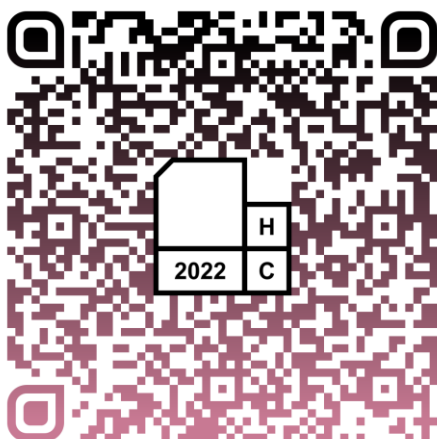
Description of activities	Teacher activities	Student activities
	Distribution of worksheets to students. Introduction to field teaching and answering any questions.	Students listen and ask questions if something is not clear to them.
Task 1	The teacher explains to the students how to use the QR code to get the data they need to solve the first tasks.	With the help of the QR code, they come to the name of cultural stations on the territory of Novi Sad.
Task 2	The teacher explains to the students how to get to the location with the help of geographical coordinates. They go to a given location and explain to them how to better see the picture of the space.	Students listen to the teacher's instructions and go to the given location with the help of geographical coordinates. They express their artistic abilities.
Task 3	Instructs students to talk to local people to get the information they are missing for the task. It helps them if they can't find all the answers.	The data is obtained in a conversation with the population.
Task 4	The teacher directs them to the tourist organization and explains to them what their task is in the same. He then explains to them how to do the task.	After visiting the tourist organization, the students make their tour, and mark on the map the paths they would take.
Task 5	The teacher explains the importance of certain localities in the city and gives them advice on how to adequately choose suitable locations.	Students research and comment on locations.
	Possible correction of the results of the lesson tasks and additional interpretations.	Students present in class a proposal for making a printed tourist guide that they have designed
Possible implementation risks	Weather conditions, Internet connection	
Note:		

Worksheet:

Key to the worksheet:

TRAILS OF CULTURE

Task 1. Scan the QR code that is attached and write on the lines below which cultural stations are located in the city and in the immediate vicinity, and then mark them (with the help of Google Maps) with numbers on the map given below. Keep in mind that one cultural station will be missing on the map.

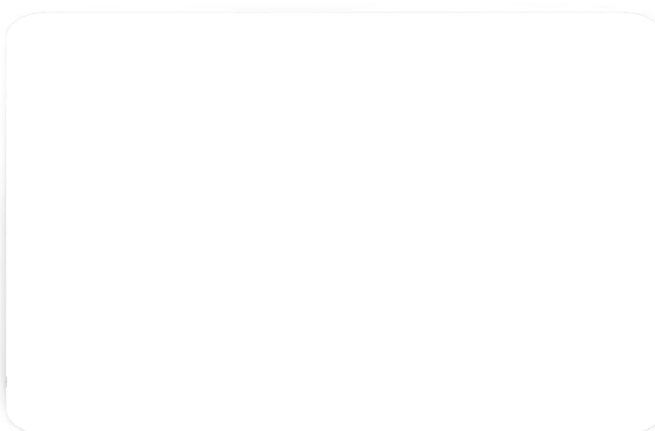


1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____



Task 2. Look at the photo attached. Based on the geographical coordinates, go to the given location, and then in the empty field, try to draw what this location looks like today. On the lines below, write down what changes you notice.

45°14'53.3"N 19°49'48.4"E



Task 3. In the conversation with the local population, get the information you will need to fill in the table given in the attachment, which is related to the location referred to in task 2.

Construction year	Original purpose	Designer	Construction style
Year of proclamation as a cultural monument	Year of reconstruction	Former name	Current name

Task 4. Go to the Tourist Organization "Carpathians", which is located in Braće Ribnikar street no. 48. Ask them in what way it is best to give a proposal for making your own printed tourist guide. Then, it is necessary to design a tour that would include at least three cultural stations in Novi Sad (you can also include museums, exhibitions, theaters...). On the map, mark the hiking trails you would follow and mark the locations you would visit.



Task 5. In the blank field, write down why you decided to take your tour along that particular trail and state the significance of the locations you would visit (historical significance, anthropogeographically, manifestations, etc.).

Activity 12 - Geophysicists - If geography was easy, they'd call it physics

The theme	Geophysicists - If geography was easy, they'd call it physics
Topic (incorporation by curriculum)	Water on land - Rivers/ Forms of relief-River erosion
Target group	ISCED2 (age 12-13, 14-15), ISCED3 (age 15-16)
Duration (outdoor, indoor part)	1 in the classroom + 1 on the field
Cross-curricular links	Physical education, Physics, Mathematics
Organizational forms	Group
Staffing	Geography teacher, physics teacher and one class of students

Teaching aids	Worksheet, smartphone, pen, notebook, map of Europe
Place of realisation Environment's specifics	The tasks were done on the example of Novi Sad (applicable in other cities with site corrections). It is a city beach. The task can be applied in other parts of the city (Serbia), with the correction of coordinates and objects that want to be studied and observed.

Required entry knowledge and skills of students	Use of smartphones; knowledge of basic mathematical operations
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field about the local environment in which they live, on the example of the action of physical-geographical factors and laws. 2. They use applications that make it easier for them to navigate in space, and through active problem solving the material learned by practical skills will be more permanent. 3. Students connect the material by correlating the skills and knowledge of various subjects. 4. Students get to know the cause-and-effect relationships in geography, and how much a change in one factor (element) affects the change in another factor (element) by solving tasks from different sciences and disciplines, 5. Students expand their knowledge in the field of physical geography (local environment) in correlation with other subjects. It offers a good basis for reviewing and summarizing previous material (multiple subjects).
Theoretical basis	The essence of atmospheric pressure, the occurrence of wind or the functions of the formation of glacial landforms - include the knowledge acquired in physics classes. In some schools, the practice of conducting integrative teaching, where physics and geography are organically interwoven. The connection between these two sciences at school is helped by students' deeper understanding of the material and concretization of knowledge. Numerous phenomena in geography have a physical basis, such as: the occurrence of wind, the circular flow of water, currents in the seas and oceans, the magnetic

	properties of the Earth... The study led to the development of a new field - geophysics.
Conclusion (evaluation)	After the lesson in nature, students should make a presentation where they will present the obtained results and conclusions from the field. Discussion and possible correction of the results are necessary. It is recommended to suggest for possible new observations of the same terrain or their application in new (similar) locations.

Suggestions of individual approach	Gifted students	Students below average
	Individual work / work in pair	Inclusion of students in a stronger group
	They will have the task of making a Padlet on which all students will place their pictures and observations	During the performance of the tasks (activity), record each activity with a camera (make a photos).

Description of activities	Teacher activities	Student activities
	In correlation with physical education, the teacher at the beginning of the class introduces students to the proverb "If someone closes the windows to the sun, he/she opens the door to disease!" Through active group conversation, students should connect these two sciences, as well as understand the importance of the sun in geography and everyday life. The geography teacher introduces the students to the topic of their activities in an interesting and funny way. Geophysicists - If geography was easy, they'd call it physics.	
	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
Task 1	The teacher points out the use of GPS, which is necessary for the realisation of the task, and takes the students to the given location.	Based on geographical coordinates or QR codes, with the help of a smartphone, students search for a given location and solve tasks.
Task 2	The teacher reminds the students that the proximity of the river (water) has always been the main factor for the formation of the settlement.	Students learn and connect geography in a different way, with mathematical (arithmetic) operations, and repeat the previous material. In this way, they additionally form an idea of the European continent and the territories through which the Danube flows and how it connects them.
Task 3	The teacher directs the students to solve geographical problems through knowledge of physics (there is also a physics teacher who additionally explains the laws of physics to students). By solving simple geographical	Through a real example, students learn about the laws of physics in geographical disciplines. By solving easier and more difficult tasks, they develop logical and abstract thinking.

	<p>problems and tasks within the teaching content, the student learns and understands phenomena, processes and relationships in nature based on physical laws.</p> <p>Converting hours to minutes and seconds is the basis for calculating local time according to coordinates.</p>	
Task 4	<p>The teacher prepares for this task with the students beforehand in the classroom. They perform well-planned steps together on the field. The physics teacher helps in the preparation of the task at school, as well as on the field.</p>	<p>Previously informed with the problem of the task, students measure and participate in the activity. In this way, they learn the skills of navigating nature without instruments.</p> <p>This is a good example for students to understand the beginnings of geographical observation, measurement, research.</p>
Task 5	<p>The teacher talks to the students about the types of rivers, the terrains through which they flow, what kind of material they carry, with a comparison of the places where they are located on the Danube (Štrand, Novi Sad). To make it easier to understand the task, the teacher mentions going to the Petrovaradin Fortress (some next class), because there is a better view on the river.</p> <p>5b) In connection with the previous task, the teacher shows an example from the image that illustrates the solution of the task in a good way.</p>	<p>Students observe the riverbank. By emphasising the characteristics of other rivers that are of different character, results are obtained.</p> <p>With the help of the Internet, students find a photo from the Petrovaradin Fortress for easier current understanding.</p> <p>5b) With the help of the Internet (or a geographical map of Europe), students follow the flow of the Danube through Serbia and find similarities in its course.</p>
Possible implementation risks		Weather conditions, internet connection
<p>Note:</p> <p>Visit to the beach Štrand out of the summer (bathing) season in order to avoid crowds, so that students can do their field work without interruption.</p>		

Worksheet:

GEOPHYSICISTS - IF GEOGRAPHY WAS EASY, THEY'D CALL IT PHYSICS

1. Based on the QR code or coordinates, find the location you need to go to.



45.23611546539962, 19.84803285141244

1a) Enter the name of the location: _____

1b) Which activities are represented at that location?

1c) Which bank (side) of the Danube are you on? _____

1d) Which geographical area is across the river?

2. The Danube is the second longest river in Europe after the _____, with a length of 2,850 km. The Danube flows through Serbia for 588 km. Before Belgrade, the Danube flows through three capitals: _____, _____, _____ (cities should be written in order according to the **upstream flow** of the Danube). Novi Sad lies 1254.98 km from the delta of the Danube in the Black Sea. What is the distance of Novi Sad from the source of the Danube?

Calculating area:

Enter the result: _____

How the Danube affected the formation and development of Novi Sad?

Repeat with the teacher:

- Where the Danube springs and where it flows at the end?

- How many and which countries does the Danube flow through?

- The Danube Corridor is an important road in Europe (**why?**), and it is known as Corridor ____ (enter the number).

3. Use an object and a mobile phone (stopwatch or watch) to measure the speed of the Danube in the sector where you are. In strictly controlled conditions by the teacher, place the object in water. Measure in advance the distance from point A where you will let the object through the water and point B where you want to stop the object.

3a) By applying knowledge of physics and the formula $v = \frac{s}{t}$ complete your task by releasing an object into the water.
(v - speed of movement; s - distance travelled; t – time travelled)

3b) Additional task:

The water current carries the raft (boat) across the Danube at speed $0,8 \frac{m}{s}$. Will the raft (boat) cross the distance 0.8 km in 15 minutes?

Calculating area::

Enter the result 3b): _____

4. Determining the width of the river - measuring the width of the Danube:
Necessary: two sticks (rods) of the same height (but not less than one meter), geometric accessories, a circle of thick cardboard (diameter 30 cm), one side of thinner A4 cardboard, duct tape, one thinner nail (not shorter than 4 cm), meter.
It is recommended to prepare with the necessary funds at school.

Procedure:

1. Construct a central angle of 45° on a circle of thick cardboard. On the edges of the circle, at the ends of both legs of the mentioned corner, tape two visors cut out of cardboard. Nail the circle so that it stands horizontally on top of one stick, and so that the nail protrudes (peeks) above the circle for the most part.
2. Stand on the bank of the river whose width we determine, notice the landmark on the other bank, exactly opposite us, and drive a free stick vertically into the ground (point A).
3. Move away along the riverbank and occasionally place the stick with the protractor vertically, until the other stick and the landmark chosen on the other side of the river are visible at an angle of 45° (point B). Then measure the distance from A to B points with a meter (steps). That is the width of the river.

Analysis: At the moment when the stick and the landmark on the other side of the river are seen at an angle of 45° , the sticks and the landmark represent the vertices of an isosceles (isosceles) right triangle. The legs of that triangle - the width of the river and the distance between the sticks - are equal in length.

Precautions: Pay attention that the river does not pose a danger to students (depth, width, speed). Measurements should be done with only three students, while the others should be at a decent distance from the riverbank.

Working area for tasks:

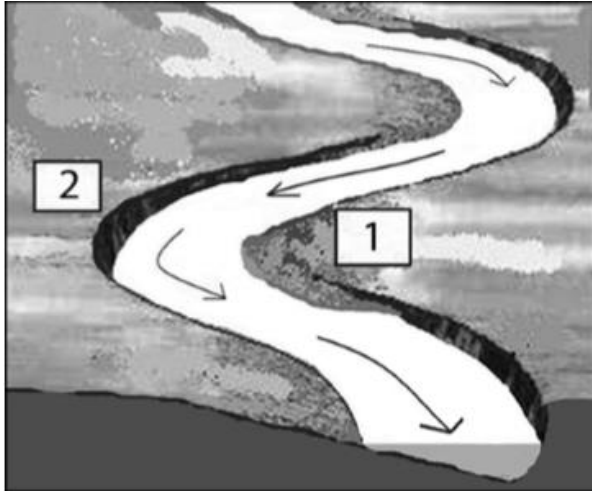
Enter the result: _____

5. 5a) Circle the features related to the Danube (in the sector of the surroundings of Novi Sad):

- a) Plain river
- b) Vertical erosion
- c) Lateral (sideways) erosion
- d) Fine and round sedimentary material
- e) Mountain river
- f) Large and unrounded sedimentary material

Explain the correct answers with a conversation with the teacher.

5b) Look at the picture below and answer the questions next to the picture writing the appropriate numbers on the lines:



7a) Place where the riverbank is predominantly shaped by river erosion is marked with a number _____.

7b) Place where the riverbank is predominantly shaped by the river accumulation is marked with a number _____.

Activity 13 - Novi Sad Fair: significance and sustainability

Theme	Novi Sad Fair: significance and sustainability
Topic (incorporation by curriculum)	Economy of Vojvodina; Orientation & navigating in local area; Acquaint of local environment;
Target group	ISCED2 (age 14-15)/ ISCED3 High school of transport and traffic (age 15-16)
Duration (outdoor, indoor part)	1 class in field + 1 class inside classroom
Cross-curricular links	Informatics, Economic Geography, Traffic, Urbanization
Organizational forms	Work in groups
Staffing	Geography teacher and one class department

Teaching aids	Worksheet, smartphone, pencil and notebook, map of Novi Sad (not mandatory)
Place of realisation Environment's specifics	All assignments were done on the example of Novi Sad, (With minor corrections, they are applicable in other cities as well). Area of the research is part of the city where the Novi Sad Fair is located. The task can be applied in other parts of the city as well (with the correction of coordinates and objects required to be studied).

Required entry knowledge and skills of students	Ability to use a smartphone
Objectives of the activity	<ol style="list-style-type: none"> 1. Students get acquainted with the transportation&traffic characteristics of the Novi Sad and the school environment. 2. They learn to use smartphone apps and maps that will assist them to navigate in space more effectively and efficiently. 3. Students get acquainted with the economic significance of the Novi Sad Fair, not only for the city itself, but also the whole region of Vojvodina. 4. Students improve abilities such as: problem solving, map analysis, critical thinking, teamwork, application of technology... 5. Students enrich their knowledge in the field of transportation and the local environment.
Theoretical basis	Bearing in mind the fact that Novi Sad is the cultural, political, administrative and economic center of Vojvodina, i.e. that it has been practically since its foundation (then not part of today's Vojvodina), it is clear that the "Novi Sad Fair" did not develop by chance right in this city, the Novi Sad Fair is one of the symbols of Novi Sad. Historical documents say that it officially exists for 80 years, but also that agricultural, craft and industrial exhibitions were held in Novi Sad in the 19th century, and fairs as the first meeting places of economic supply and demand from various parts of the world much earlier. Observing the impact of the Novi Sad Fair on the economy of Novi Sad, it can be concluded that there are two types of economic effects, namely the measurable or direct effects and the multiplicative or indirect effects (Samardžija, Ivkov, 2003).

Conclusion (evaluation)	After the lesson in the field, students are required to put together a presentation, in which they will present the obtained results and conclusions from the field. Discussion and possible correction of the results will be included.
-------------------------	---

Suggestions of individual approach	Gifted students	Students below average
	Leaders of the groups	Inclusion in stronger groups

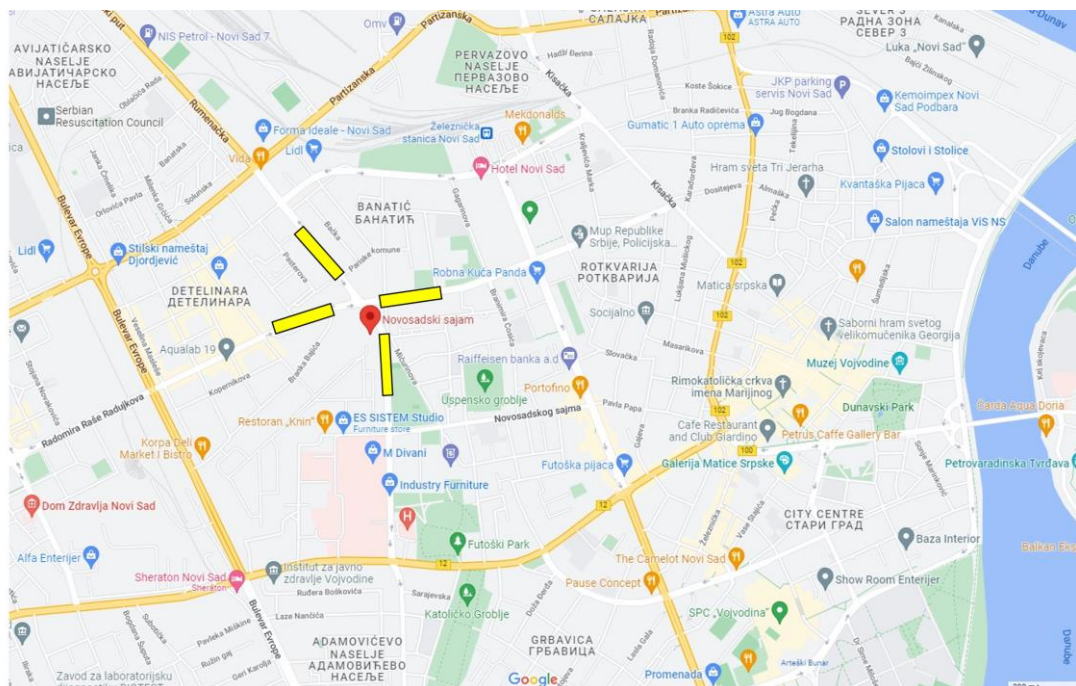
Description of activities	Teacher activities	Student activities
	The teacher guides the students to the Novi Sad Fair, describe to them use and purpose of the Fair, events that are occurring there and its economic significance for Novi Sad and the whole region of Vojvodina.	Students listen and ask questions if something is not clear to them.
Task 1	- The teacher hands out worksheets to the students, shows them city map of Novi Sad and briefly demonstrate how google maps is used.	- Students observe and analyse the city map of Novi Sad together with the teacher. Afterwards, each student opens a google map on his phone and gets acquainted with the nearby area around the Novi Sad Fair. - Solving the first task in the worksheet.
Task 2	- Present the application that is necessary to complete the task and helps students use it.	- Students use the app. The bus stops they notice in the app, they try to distinguish in real-life. - They fill in the table in the worksheet.
Task 3	- He explains to the students how to use the website. - Shows them a map of bus lines and leads them to conclude which parts of the city are not directly connected to the Novi Sad Fair via public transport.	- They open a website on their phones and enter the bus numbers they previously noted. - Next, they analyse the map of Novi Sad with the visible bus routes of the selected buses. - They draw a conclusion about the quality of the transport network. - Writing down the answers in a worksheet.
Task 4	- Teacher explains to the students different parking zones in Novi Sad. - Helps them understand the map of the parking areas in Novi Sad. - Indicates an insufficient number of parking spaces.	- They scan the QR code from the worksheet and download the pdf map. They analyse it with the assistance of the teacher. - Next, they locate where they are now on the pdf map and observe the parking spots around them in real-life.

		- Lastly, they write down their opinions in a worksheet.
Task 5	- Teacher talks to students about the positive and negative impact of the Novi Sad Fair on the local environment.	<ul style="list-style-type: none"> - Students engage in a conversation with the teacher. - In addition, they fill in the table in the worksheet and write down their opinion. - Ultimately, they conclude the importance and influence of the Novi Sad Fair on the local environment.
Task 6	- Assigns homework to students.	- Students finish their homework at home.
Possible implementation risks		Internet connection, weather
Note:		

Key to the worksheet:

NOVI SAD FAIR: SIGNIFICANCE AND SUSTAINABILITY

Task - 1. In the attachment, observe the map and find where the Novi Sad Fair is located, subsequently use the Google maps or city map of Novi Sad to enter street names in blank fields.



Task - 2. Please download the “Nsmart” application from the GooglePlay/AppStore. Use the app to find four closest bus-stops to the Novi Sad Fair (please select one bus-stop from each of the streets listed in the previous task) and write down the numbers of the all buses that pulls over at each bus-stop.

Street name:	Bus-stop name:	Numbers of the buses:

Task - 3. Please visit the following website: <http://www.gspns.co.rs/mreza> (in case you access it from the phone, rotate your screen horizontally), and select the bus numbers gathered in the previous task. On the map, you will be shown the transportation network of the selected buses. Please answer the following questions:

1. In your opinion, is the Novi Sad Fair well connected with the rest of the city?

2. Are there any parts of the city that are not directly connected by bus with the Novi Sad Fair?

3. What other type of transportation can people use to get to the Novi Sad Fair?

Task - 4. Please scan the attached QR code. Download and open the pdf document. On the map try to locate the area of the Novi Sad Fair. Answer the question below.



In your opinion, is there enough parking spaces in the immediate vicinity of the Novi Sad Fair?

Task - 5. In the table below, write three positive and three negative effects of the Novi Sad Fair on the local environment. Subsequently, write your opinion on what would you do to improve this area.

Positive:	Negative:

How would you improve/enrich/change this area?

Task - 6. For homework, scan the QR code below and watch the video clip of the upcoming international agricultural fair held in Novi Sad at the location we visited.



Activity 14 - Measuring water pollution in the city area

Theme	Measuring water pollution in the city area
Topic (incorporation by curriculum)	Pollutants in nature; human impact on pollution; water pollution
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	One laboratory class + one fieldwork class
Cross-curricular links	Chemistry, biology, Environmental protection, Chemistry
Organizational forms	Group
Staffing	Geography teacher and chemistry teacher + one class

Teaching aids	Paper, pen, colorimeter device, water containers
Place of realisation Environment's specifics	Tasks are performed near a larger body of water or several bodies of water. It is necessary that the area where the field classes will be held be easily passable and accessible for taking samples.

Required entry knowledge and skills of students	It is necessary for students to be acquainted with various water pollutants and to know what leads to pollution of water.
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with how certain pollutants (waste-water, detergents, etc.) affect the change of physical and chemical composition of water; 2. Students try to recognize the impact of people on water pollution and its environment; 3. Students introduce to the work of a colorimeter and work in the laboratory; 4. Students independently research and present their conclusions. 5. Students learn to recognize changes in the physical and chemical characteristics of water and learn about basic traits of pollutants.
Theoretical basis	<p>Geography is very closely related to ecology. These two sciences are so closely related to each other that sometimes even the object of their study is identified. Any solution to the ecological problem is simply impossible without referring to the aspects of geographical science. The connection between ecology and physical geography is particularly strong. This resulted in the formation of a completely new science - geoecology. This is a complex applied discipline that studies the structure, properties and processes that take place in the human environment, but also in other living organisms. Another discipline from the group of natural sciences, which is quite close to geography, is chemistry. It especially interacts with soil geography and pedology. Based on these connections, new scientific branches arise and develop. It is primarily geochemistry, hydrochemistry, atmospheric chemistry and landscape geochemistry. Studying some topics in geography is simply impossible without appropriate knowledge of chemistry. First of all, we are talking about the following issues: the spread of chemical elements in the earth's crust; chemical structure of the soil; soil acidity; chemical composition of</p>

	water; salinity of ocean water; aerosols in the atmosphere and their origin; migration of substances in the lithosphere and hydrosphere (https://valenteshop.ru/bs/svyaz-geografii-s-drugimi-naukami-o-prirode-o-svyazi-sovremennoi-geografii/).
Conclusion (evaluation)	Students will tabulate /graphically present the results obtained after processing the data in the laboratory.

Suggestions of individual approach	Gifted students	Students below average
	Individual work	Including students in a stronger group
	Students should prepare a short presentation on the types of pollutants in the measuring area and discover how to prevent further water pollution.	Students are in groups with other students and with their help and the help of the teacher they fill in Worksheet 2 where they indicate the physical characteristics of the water.

Description of activities	Teacher activities	Student activities
Task 1	Introduction with field work, preparation for sampling; Draw students' attention to the fact that the obtained samples do not mix with other substances during the measurement; renew knowledge of environmental pollutants; division of students into groups.	Students actively listen to and note guidelines for fieldwork; ask questions and resolve any doubts with the teacher.
Task 2	Fieldwork: one group of students goes with the geography teacher to the measuring area so that they can take water samples needed for work; The other group goes with the chemistry teacher to another measuring area and also takes samples; teachers repeat the tasks once again.	Students, divided into groups, follow the teacher to the measuring area where the fieldwork will be performed.
Task 3	The teacher distributes sample bottles and gives the students two bottles where everyone will have the opportunity to take a certain sample; Teachers monitor the work of students and help if help is needed.	When sampling, students write on the paper the basic physical characteristics of water - color, turbidity, temperature (or whether the water is hot or cold), the color of certain substances in water.
Task 4	After the sampling, the teachers go to the laboratory together with the students, where they get acquainted with the work of the colorimeter and help the students how to determine the number of certain substances in the samples.	Students write down on paper the guidelines for working on the colorimeter, on which occasion each of them puts their two samples in the device and records on paper the data obtained from the device.

Task 5	Teachers monitor the measurement and help if needed; They correct certain mistakes, if any, and record student activity.	When students record the data on paper, each of them has the opportunity to present their observations and data obtained in the field and in the laboratory, where they then compare with the results of the other group.
Possible implementation risks	seasons, weather conditions, mixing other substances with water samples	
Note:		

Worksheet 1:

MEASURING WATER POLLUTION IN THE CITY AREA

Task 1. When taking a water sample, it is necessary to write the observed physical characteristics of water (temperature, color, odors, turbidity, additional substances) in Table 1.

Table 1. Physical characteristics of the water sample

	Sample 1	Sample 2
Temperature (warm, cold)		
Color (dark, light, yellow, black, gray, etc.)		
Smell (strong, faint, some specific smell)		
Opacity / transparency (is the sample transparent, if not what is the opacity - strong, weak)		
Additional substances and their size (contours of sand, silt, etc.)		

If you notice physical characteristics that are not in the table, write them down below.

I noticed:

Task 2. What can you conclude from the observed changes in the physical characteristics of water? Do you think that the water is polluted, if so, why do you think that it is polluted?

Task 3. What are the most common water pollutants in Serbia?



Task 4. What is your opinion on the condition and quality of water in Novi Sad?

Worksheet 2:

Task 1. Table 2 contains the physical characteristics of water (temperature, color, odor, turbidity, additional substances) that need to be noted in the table. For each sample, put a sign ✓ in a particular column if you notice this property in the sample, and if you do not notice, put a sign ✕ in the column.

Sample 1.









Temperature

Warm			Tepid			Cold		
Color								
								
								
Colorless	Grey	Dark/Black	Yellowish	Ocher	Brown	Light green	Darkgreen	Reddish
Odor								
Odorless		Faint odor			Strong odor		Specific odor	
Turbidity/Transparency								
Transparent		Transparent with substances		A little turbid		Turbid		Turbid with substances
Additional substances								
Without any		Sand		Sludge		Gravel		Other

If you notice physical characteristics that are not in the table, write them down below.

I noticed:

Sample 2.

Temperature								
Warm			Tepid			Cold		
Color								
								
								
Colorless	Grey	Dark/Black	Yellowish	Ocher	Brown	Light green	Darkgreen	Reddish
Odor								
Odorless		Faint odor			Strong odor		Specific odor	
Turbidity/Transparency								

Transparent	Transparent with substances	A little turbid	Turbid	Turbid with substances
Additional substances				
Without any	Sand	Sludge	Gravel	Other

If you notice physical characteristics that are not in the table, write them down below.

I noticed:

Activity 15 – Museum through AR

The theme	Museum through AR
Topic (incorporation by curriculum)	Getting to know the local environment; Historical development of settlements, Cultural heritage of Serbia, Technical and digital literacy
Target group	ISCED2 (age 14-15), ISCED3 (age 16-17)
Duration (outdoor, indoor part)	1 hour in the field + 1 hour in the classroom
Cross-curricular links	Geography, History, Technique and Technology, Geoinformatics, Biology, Ethnology
Organizational forms	group
Staffing	Teacher of geography and teacher of technique and technology and one class

Teaching aids	Worksheet, smartphone, pen, and notebook
Place of realisation Environment's specifics	The tasks were done on the example of the Museum of Vojvodina in Novi Sad (applicable in other museums and cities with minor corrections). The museum is located in the city centre.

Required entry knowledge and skills of students	Use of smartphones
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field with the features of the museum using modern technical achievements. 2. They use AR technology that will make it easier for them to get acquainted with known and unknown spaces in a different way. 3. Students get to know the historic development and features that are located and kept in the museum. 4. Students expand their knowledge in the field of history and the use of modern technology, which will increase the level of their digital literacy.
Theoretical basis	Augmented reality system augments the real world with virtual (computer generated) objects that appear to coexist in the same space as the real environment" and define this system with three properties: 1) it combines real and virtual objects in the real environment; 2) works interactively and in real time; and 3) mutually registers (aligns) real and virtual objects. It is also defined as a variation of virtual reality in which virtual 3D objects are integrated into the real environment and are available in real time to improve the user's perception and interaction with the real world (Stojšić, 2019).
Conclusion (evaluation)	<p>After class in the museum, students should make a presentation in which they will present objects that they have painted and that have attracted attention.</p> <p>Discussion and possible correction of results.</p>

Suggestions of individual approach	Gifted students	Students below average
	They will have the task to paint and record something from the museum that they liked the most and to make a short presentation about it.	Inclusion of students in a stronger group

Description of activities	Teacher activities	Student activities
Task 1	Distribution of worksheets to students, introduction to fieldwork, answering any questions.	Students listen and ask questions if something is not clear to them.
Task 2	The teacher shows the students the application they will use in the museum. With the help of the application, they will show the steps of operation on one example.	Students listen carefully to the teacher's instructions.
Task 3	The teacher goes to the first part of the museum with the students and explains which of the objects are there.	Students use the app to listen to and walk around the museum. They note in the notebook what they noticed and what they liked. They take photos and videos.
Task 4	Possible correction of the results of assignments in class.	Students present prepared presentations from the field in class, expressing their impressions.
Possible implementation risks		Internet connection
Note:		

Key to the worksheet:

MUSEUM THROUGH AR

Task 1. Based on geographical coordinates, using a smartphone, try to find a given location using Google Maps. Write the name of that location on the line next to it. Also, use the Google maps app to see if there are any more museums nearby.



45°15'23"N 19°51'8"E _____

Task 2. With the help of the application "Museum omniscient" and the manual from the Museum, scan page 8 and do the task that is on it.

Task 3. Take a selfie with a Roman helmet and insert the picture on the worksheet.



Task 4. Scan page 7 in the manual and mark two identical houses.

Task 5. Write your opinion about this museum and about this way of visiting the museum and getting acquainted with the settings in it.

Activity 16 - My city through tourist locations

Theme	My city through tourist locations
Topic (incorporation by curriculum)	Orientation and getting to know the place where we live better; Getting to know local environments, cultures and traditions, Historical development of the settlement, Tourist routes of the city
Target group	ISCED3 (age 17-18, 18-19) Students of the third and fourth grade of the high school of tourism
Duration (outdoor, indoor part)	1 hour in the field + one hour in the classroom
Cross-curricular links	Geography, English language, History, Biology, Tourist geography, Geoinformatics
Organizational forms	In the group
Staffing	Teacher of tourist geography and one class of students

Teaching aids	Worksheet, smartphone, pen and notebook
Place of realisation Environment's specifics	The tasks were done on the example of the city of Novi Sad (applicable in other cities with corrections against tourist attractions) This is a part of the city near the city center (Dunavska street, Danube Park, Museum of Vojvodina and museums in that area. The task can be applied in other parts of the city, with the correction of coordinates and changing the types of objects in the environment to be studied.

Required entry knowledge and skills of students	Use of smartphones and orientation
Objectives of the activity	<ol style="list-style-type: none"> 1. Students learn through teamwork in the field get acquainted with the local environment. The environment in which they live and where the school is located, as well as the cultural historical heritage, through insight into both good and bad things in environment; 2. They use the applications that will make it easier for them navigating the space, as well as scanning QR codes and using them GoogleMaps applications 3. Students get to know the historical development of different parts settlements in which they live, will have the opportunity to give their own opinion and proposal for improvement of certain tourist sites; 4. Students understand how much the locations have affected and how much they affect today the environment; 5. Students improve their knowledge of the local environment and improve their own communication skills through teamwork.
Theoretical basis	Significant tourist centers are inseparably linked with their gravitational zone, which together make up a tourist destination, or tourist region. The tourist region is a complex spatial unit, composed of a number of elements, such as primary, secondary and tertiary tourist centers, then gateways of tourist flows, intraregional network of roads, as well as directions that make tourist flows to the tourist region. Therefore, the formation of a tourist region model on

	previous element and ideas must be the basis for the development of tourism in each tourist center, which has predispositions to be primary. Therefore, there is no doubt that Novi Sad is an important gravitational center and that it represents a functional center of a wider area in the geographical sense. As far as tourism goes, it should be said that Novi Sad is the second city in the Republic of Serbia in regards to its realized tourist traffic. Looking in relation to AP Vojvodina, Novi Sad participates in the Provincial tourist traffic with 31,7% overnight stays and 39,3% tourists, which clearly proves its significance as a tourist center within the Province (Garača et al, 2019).
Conclusion (evaluation)	After the class in nature, students should summarize what they visited, as well as to present the results and conclusions from the field in groups in the next class. The conclusions should be used for understanding meanings of the activity and to point out that the students will be they who are responsible for the state of tourism in their city in the future. Discussion and possible correction of results after exposure.

Suggestions of individual approach	Gifted students	Students below average
	They can get an extra assignment to prepare a presentation about specific locality (such as local guide / curator) and if they want, they can prepare everything in English	Involving students with better students from the class, so they would motivate them to get more involved

Description of activities	Teacher activities	Student activities
	Designing activities, preparing and giving worksheets to students, introduction to field teaching, answering any questions and ambiguities.	Students listen the explanations of the tasks and they can ask questions if anything is not clear. In addition, they are trying to do tasks correctly and conclude the meanings of activities and see the beauty and importance of classes outside the classroom.
Task 1	The teacher show students how to scan the QR code and refers them in assignments that should be doned.	Based on geographical coordinates or QR code, with smartphone, search 3 default locations and responing to asked questions.
Task 2	The teacher go to the locations with the students. The point is to make students realize value of cultural institutions in that part of the city and see the importance of visiting them.	Students go to the locations which they can find by using Google Maps. For all three locations they need to count number of people at the moment, then they need to find out and learn something about the history of institutions and important Items/documents placed in institutions

		and think how they could initiate local people to visit institutions.
Task 3	The teacher goes to the city center with students and tells them about the importance of the city center of Novi Sad	Students go to the given location and inquire about the history and development of the street through the years.
Task 4	The teacher shows a photo of one street work art and tells students in which direction to go.	Students are researching which location is in task and are trying to recognize the respectable and important historical figures it contains. They also need to respond on questions about the environment and conclude can importance of history come closer with this way of representation.
Task 5	The teacher directs the students to the task and the map in which they should draw location.	Students have the opportunity to think about which one is, according to them, the most interesting tourist destination of all visited during this activity. Around that, it is necessary to draw the chosen location on the city map. They need to consider methods to make that location better positioned on the list of attractions that are necessary when visiting the city. They also need to prepare speech about the chosen location, imagining that they are tour guides on the next class.
Possible implementation risks		Weather conditions, Internet connection
Note:		

Key to the worksheet:

MY CITY THROUGH TOURIST LOCATIONS

Task 1.

Based on geographic coordinates or QR code, with the help of a smartphone, try to find location and access them using Google Maps. Write on the lines which locations are in question and answer on other questions below.

QR code 1.



QR code 2.



QR code 3.



LOCATION	In your opinion, what is the tourist significance of the given locations?	Did you find any information boards on the location? Is it important that they are set up and did they mean something to tourists when visiting?	How is this location important and does affects for the number of visitors to the city today? Enter a score from 1 to 5.
1. _____			
2. _____			
3. _____			

Task 2.

Using Google Maps, find these locations on our own.

- Museum of the City of Novi Sad
- Historical Archive of Novi Sad
- Museum of Contemporary Art

Describe the situation you found at the locations, observing the number of people at a given moment, as well as the maintenance of the place.

Inquire about the year of establishment of the mentioned institutions and write what you found out below. Also inquire about the most important items/documents.

1st Location

2nd Location

3rd Location

How do you think it can influence the local population to visit regular exhibitions or some workshops that can be realized in the mentioned institutions? _____

Task 3.

Put yourself in the role of a tourist in your city.

While walking through Dunavska Street, pay attention to the building styles and the beauty of the buildings in the street. What is your opinion about the current situation in one of the most popular streets in Novi Sad?

For the next class, try to inquire about the significance and appearance of this street through the history. Also, think about how to attract tourists and how to make a walk along this street unavoidable during the city tour.

Below, in short theses, write down what you learned.

Task 4.



In the photo is: _____

Try to find out when the mural from the picture was created and which are all the important personalities of Novi Sad shown on it. What famous historical people are on it? _____

Which two monuments are nearby? _____

What important educational institution is nearby? _____

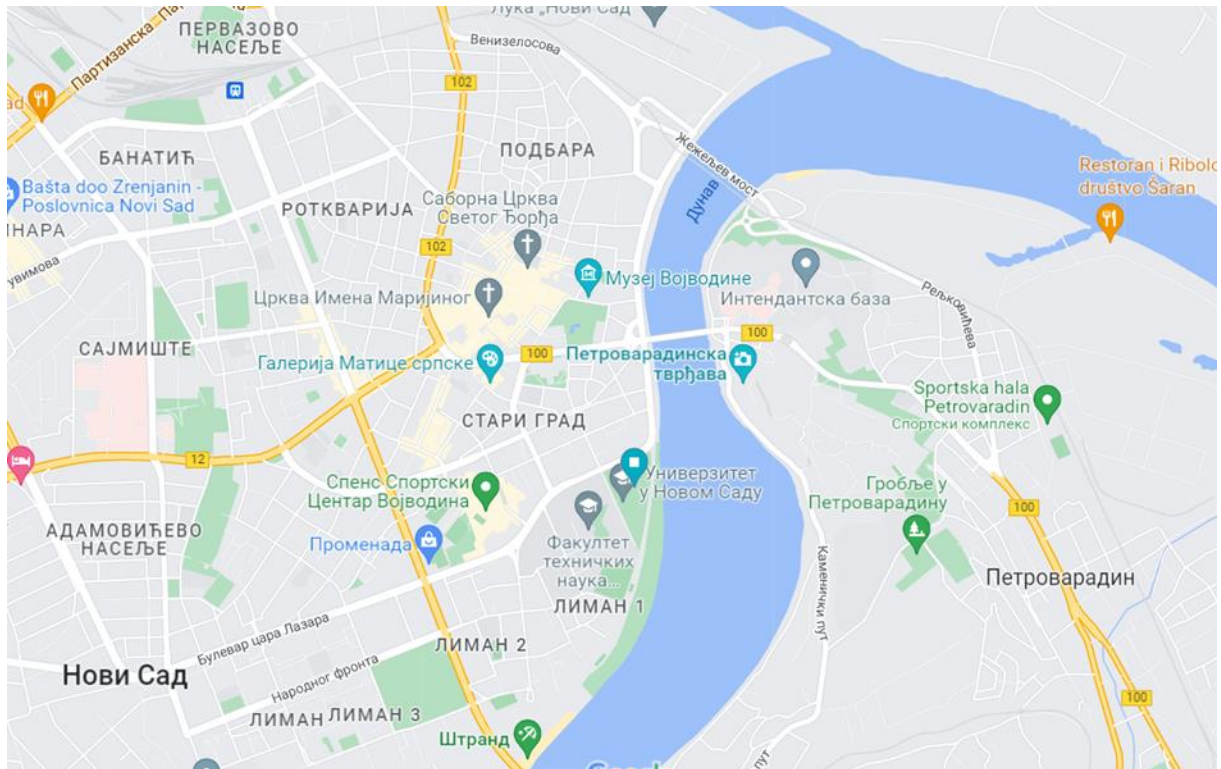
Do you think that the location is important for showing the history of the city center and do you think that it can point out the importance of this part of the city?

Take a group photo in front of this place.

Task 5.

Imagine that we are tourist guides of the city. Consider which of the tourist attractions mentioned above in this task would be the most important?

Mark that location on a city map.



What would you do to improve the visibility (and the number of tourists) on the tourist map of Serbia?

For the next class, prepare a short presentation of the chosen location for a group of tourists, imagining that you are **their guide**.

Activity 1 - Light pollution research in the bright part of the day

Theme	Light pollution research in the bright part of the day
Topic (Curriculum)	Elementary School: Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia - settlements; Economy of Slovenia; Home region - geographical features; Excursions
	GIM and other secondary schools: Settlements, Energy and Industry; Sustainable Development; Slovenia - regional and environmental contradictions, Excursions etc.
Target group	ISCED2 (age: 14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	25 minutes of classroom preparation, 45 minutes of fieldwork, 20 minutes of synthesis outdoors or in the classroom
Cross-curricular links	Physics, technology, biology, home economics, mathematics, informatics
Organizational forms	Preparation - frontal work; implementation in the field - work in pairs or in groups, synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	worksheet with cartographic base, smartphone (camera, interactive light pollution map – free online: https://www.lightpollutionmap/), pen.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other area (another cartographic base is attached).
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital competences are required (working with a smartphone, camera, interactive map on the Internet).
Objectives of the activity	<ul style="list-style-type: none"> - make an inventory of public street lighting (type of lamp, installation of the lamp) and other possible sources of artificial light in the chosen area; - make a comment on the light pollution of the area and compare your conclusions with light pollution interactive map – free online.
Theoretical basis	We distinguish between natural and artificial light. Natural light supports our health. By inventing artificial light, we have improved people's quality of life, especially at night. We imagine artificial light differently – we can think of different lights at home, in bars and shops, street lighting, lighting of sports areas, traffic routes and stops, billboards, lighting of cultural heritage and so on.

	<p>Through time artificial light has become self-evident. But living beings urgently need darkness too, which we receive less and less. The rhythm of light and darkness is important for our internal biological clock, which harmonizes all living beings with the environment (exposure to artificial lights at night reduces the formation of anticancer melatonin, affects the time of the outing of nocturnal animals and thus their ability to eat, their orientation and more). So – too much artificial light affects the quality of our living and the reduction of biodiversity.</p> <p>Light pollution is most effectively observed at night when light sources are on, but it can be explored at least in part in daylight. At that time, we can observe artificial light sources, which are often improper and incorrectly installed, which causes the excessive lighting (or lack of darkness) and thus light pollution.</p>
Conclusion (evaluation)	In step C on the worksheet, students in pairs or small groups compare their own conclusions from the field with the objective results shown on the interactive light pollution map, and suggest ways to reduce light pollution in the selected area. In the joint synthesis of the whole class, the students compare the findings for the different areas in which they have researched and generalize the results for the larger part of the city.

Individual approach suggestions	Talented student	Less-gifted student
	They conduct research in a larger area.	They conduct research in a smaller area.
	They perform a more detailed analysis and prepare more in-depth proposals in step C.	They investigate only one element (eg type of lamps or placement of lamps).
	They prepare a synthesis presentation of the results of the field assignment for the whole class (poster for the exhibition, publish an article in the school or local newspaper)...	Inclusion in a heterogeneous group.

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <ul style="list-style-type: none"> • explanation of theoretical foundations, • examination of the worksheet, division of students into pairs or groups, division of the area into research zones of individual 	<ul style="list-style-type: none"> • Get to know or refresh the general problem of light pollution, recognize the types of street lamps, the problem of proper mounting of lamps and other sources of artificial light that can be explored in the bright part of the day,

	groups, • lead a conversation about the security plan,	<ul style="list-style-type: none"> • review the worksheet and required work procedures, divide into groups, mark their group's research area on the map - step A on the worksheet, • get to know and co-create the rules of safe research on the streets.
task 2	Leads the students to a common starting point (agreement on meeting point).	They orient themselves with a map, prepare for field work.
task 3	Monitors the work of the groups and advises if necessary.	In groups, they carry out step B on the worksheet (identify, count, photograph different types of street lamps; identify, briefly describe, photograph examples of improper installation of street lamps; identify, briefly describe, photograph and mark the location on the map of other sources of artificial light).
task 4	Monitors the work of the groups and advises if necessary.	In groups, they perform step C on the worksheet (draw a conclusion about possible light pollution based on the results of their research, compare their conclusion with the data on the interactive map, propose possible solutions to reduce possible light pollution).
task 5	Leads the synthesis, derivation of final substantive conclusions and the plan for further work.	The groups present the results of the work (worksheet solutions). They compare and generalize the results for the entire considered area with an emphasis on proposed solutions. They make a plan for a possible presentation of the results to the school or other public.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.
Note: /		

Key to the worksheet: /

Light pollution research in the bright part of the day

Light pollution is most effectively observed at night when light sources are on, but it can be explored at least in part in daylight.

In this fieldwork exercise you will explore the type of street lamps located in the selected part of Maribor and if they are properly installed. Based on your findings, you will draw conclusions about the intensity of light pollution in the selected area and compare it with an interactive map of light pollution. When sharing the results of your work with others, you will be able to contribute to a higher quality of life in Maribor, which does not affect only economic power, but especially the connection with the natural laws of life.

A

Choose a part of any street in selected area of Maribor (app. 500 meters to one kilometer long). Mark it on the map.

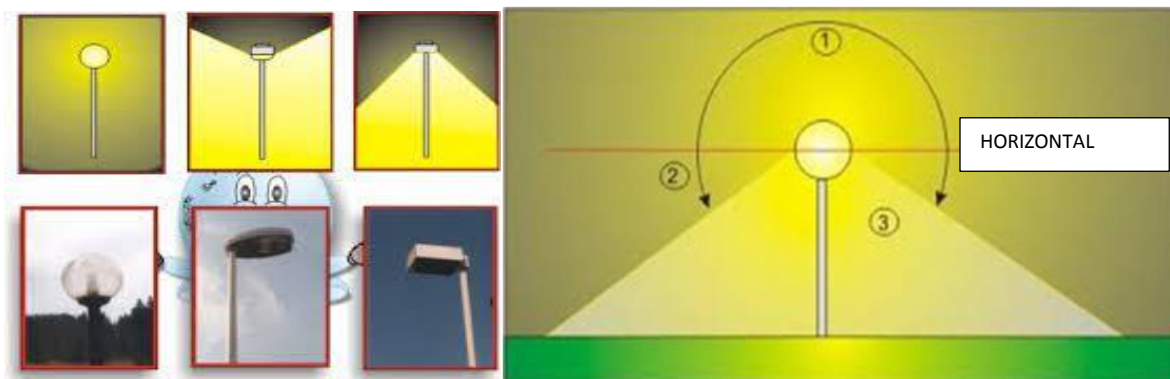


B

Record in Table 1:

- **lamp type** (unshaded, partially shaded, fully shaded); photograph the predominant lamp types:

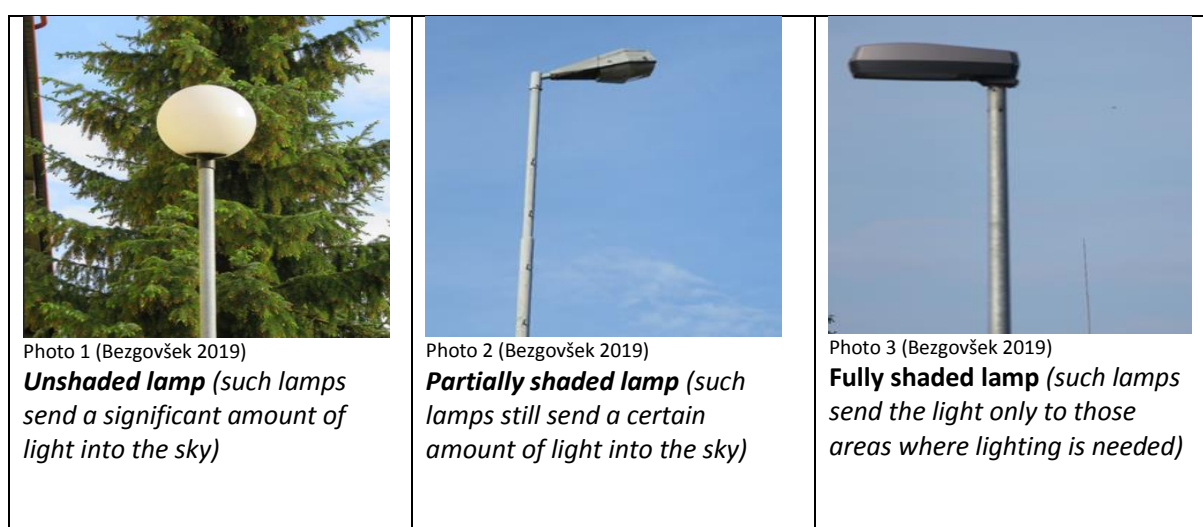
Light effect of different lamps



<http://www2.arnes.si/>

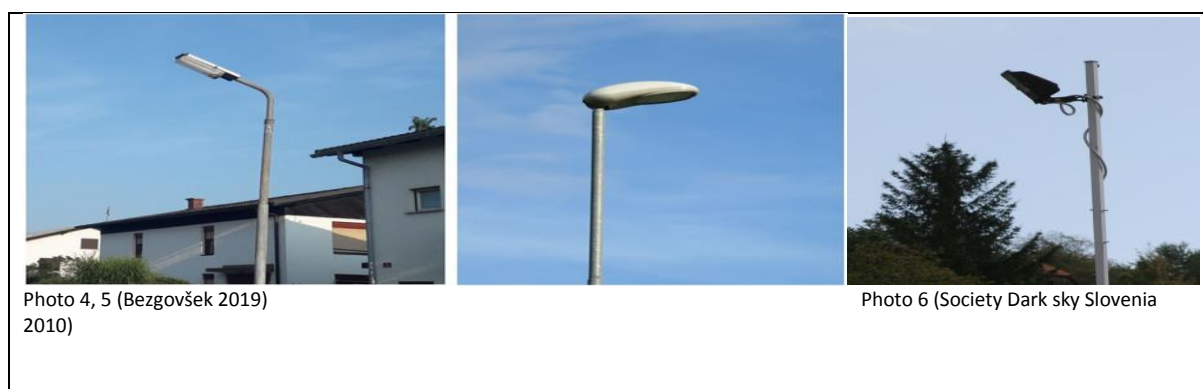
eko-generacija.org

Examples of lamp types:



- the installation of the lamp; photograph some examples of possibly improperly installed lamps:

Examples of improper installation of lamps (Older generations of lamps needed a $7^\circ - 10^\circ$ inclination to properly illuminate surfaces, newer fully shaded lamps do not require an inclination, however they are often mounted on old candelabras or placed on a new candelabra at a smaller angle because of the belief that they will illuminate wider surroundings. **Also an environmentally friendly lamp with an inclination of 0° glows above the horizontal and pollutes the environment.**)



Examples of proper installation of lamps (inclination of the lamp is 0 ° according to the horizontal)

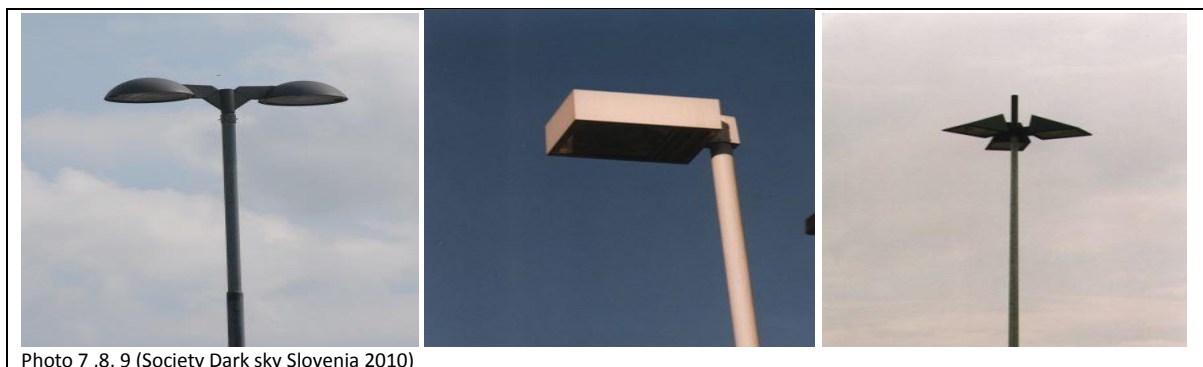


Photo 7 ,8, 9 (Society Dark sky Slovenia 2010)

- any other sources of artificial light that you may notice during the day.

Table 1: Form for inventory of outdoor lighting

1 Type of the lamp - proposal for recording: one lamp is one line (1 lamp = l)

2 Lamp installation form: brief description of the case

<u>PUBLIC STREET LIGHTING</u>			<u>Number of lamps</u>	<u>% of lamps</u>
1 TYPE OF THE LAMP	<i>Unshaded</i>			
	<i>Partly shaded</i>			
	<i>Fully shaded</i>			
2 LAMP INSTALLATION FORM	<i>Case 1:</i>			
	<i>Case 2:</i>			
	<i>Case 3:</i>			
	<i>Case 4:</i>			
	<i>Case 5:</i>			
<u>OTHER SOURCES OF ARTIFICIAL LIGHT</u>				
CASE 1:	Description:			
	<i>Location:</i>			
CASE 2:	Description:			
	<i>Location:</i>			
...				

C

Based on the results of Your research, comment on the possible light pollution of the area. Compare your conclusions with lightpollution map (free online).

Concider: regular values of light pollution range between 16 in 22 mag/arc sec² (magnitude per square arc second). Value 16 means very light polluted measurement and value 22 means a darker sky.

Suggest a way to prevent or reduce light pollution in a selected part of Maribor.

Activity 2 - Light pollution research by night

Theme	Light pollution research by night
Topic (Curriculum)	Elementary School: Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – Settlements, Economy of Slovenia, home region - geographical features, excursions
	GIM and other secondary schools: Settlements, Energy and Industry, Sustainable Development, Slovenia - regional and environmental contradictions, excursions
Target group	ISCED2 (age: 14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	45 minutes of preparation in class, 90 minutes of field work, 45 minutes of analysis and synthesis in class
Cross-curricular links	Technology, physics, biology, home economics, mathematics, informatics
Organizational forms	Preparation - frontal work, implementation in the field - work in groups
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	SQM meter, measurement area map, data entry table, pen, smartphone (camera)
Place of realisation	Maribor (any other location is possible)
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital competences are required (work with SQM meter, smartphone, camera)
Objectives of the activity	<ul style="list-style-type: none"> - They learn about the problem of light pollution, - state the causes of light pollution (lamp type, lamp spectrum), - show the differences in the level of light pollution between the settlement and its surroundings, - they consider how to reduce light pollution in the local environment.
Theoretical basis	Since prehistoric times, man has used various ways of lighting the environment at night. At first, oil lamps dominated, but from the 19th century onwards, they were slowly replaced by gas lamps. Artificial light began to be used more intensively at night after the invention of electric lamps. The latter appeared in various versions in the 20th century. Today, the problem with night lighting is not only the intensity of the lamps, but

	<p>also their spectrum. LED lamps, which have recently been spreading in our country as well, are more energy efficient, but due to their brightness, especially in the blue part of the spectrum, they leave much greater spatial effects. According to Rayleigh's law, the scattering of light is inversely proportional to the linear power of the wavelength. In other words: blue light (with a wavelength of 400 nm) shines through the atmosphere sixteen times more intensely than red light (with a wavelength of 800 nm). Amateur and professional astronomers were among the first to point out the problems caused by the mass use of lamps, and later ecologists, and today medicine also warns of the negative effects of the mass use of lamps at night on human health. Exposure to artificial light interrupts the formation of the hormone melatonin, which makes such people more exposed to the dangers of various forms of cancer. Excessive use of lamps at night is also an important source of energy consumption.</p> <p>Analyzes of satellite images in the night channel show that 83% of the world's and 99% of Europe's population live in a light-polluted nighttime environment. Due to the light-polluted night sky, a third of the world's population, 60% of Europeans and 80% of North American residents are deprived of a view of our Galaxy (the Roman road). The most polluted countries are Singapore (100% of the population lives in light-polluted night-time conditions), Kuwait (98%), Qatar (97%), United Arab Emirates (93%), Saudi Arabia (83%), South Korea (66%) , Israel (61%), Argentina (58%), etc. The areas with the least light pollution are Greenland (0.12%), Central African Republic (0.29%), Somalia (1.2%) and Mauritania (1.4%). The data can of course be misleading if we do not know how to interpret it and can manipulate it, but it nevertheless points to the fact that the economic success of a country does not yet guarantee a quality living environment.</p>
Conclusion (evaluation)	They compare the results of the fieldwork, summarize the differences in light pollution between the settlement and its surroundings. In doing so, they try to connect the results of the measurements with the type of lamps and the spectrum of lamps.

Individual approach suggestions	Talented student	Less-gifted student
	They perform measurements in several settlements.	They conduct research in a small area.
	They perform measurements in secured (remote) areas.	They join a heterogeneous group.
	Based on the measurements, they create a light pollution map for the local landscape.	

Activity scenario	Teacher activities	Students' activities
-------------------	--------------------	----------------------

task 1	Preparation for field work: <ul style="list-style-type: none"> • explanation of theoretical foundations, <ul style="list-style-type: none"> • reviewing the worksheet, dividing students into pairs or groups, dividing the area into research zones for individual groups, leading a discussion about the safety plan. 	<ul style="list-style-type: none"> • Get to know or refresh the general issue of light pollution with, • review the required work procedures, divide into groups, mark their group's research area on the map.
task 2	Leads the students to a common starting point (agreement on meeting point).	<ul style="list-style-type: none"> • They perform measurements, enter the values into the form and calculate the average values by measurement points.
task 3	Monitors the work of the groups and advises if necessary.	<ul style="list-style-type: none"> • Enter data into the card.
task 4	Monitors the work of the groups and advises if necessary.	<ul style="list-style-type: none"> • They analyze light pollution according to the dominant type of lamp and the spectrum of lamps by measuring points.
task 5	Monitors the work of the groups and advises if necessary.	<ul style="list-style-type: none"> • Propose measures to reduce light pollution.
Implementation risks		Students take the measurements accompanied by a teacher in a rented bus. The teacher warns the students to follow traffic regulations while taking measurements.
Note: /		

Key to the worksheet: /

Light pollution research by night

Since the beginning of the use of fire, man has only used it for lighting at night. Historically, lighting technology changed very slowly at first. In the period between the Sumerian civilization and the beginning of the 19th century, the technology of night lighting did not change significantly. Oil lamps dominated, which in the 19th century were slowly replaced by gas lamps, and at the end of the 19th century by electric lamps. The latter appeared in various versions in the 20th century. Recently, high-pressure sodium lamps are increasingly replacing the so-called LED lamps. With the advance of lighting technology, with changing living habits and with the expansion of cities - especially after the Second World War - the widespread use of lamps also increased. Especially in cities, amateur and professional astronomers were among the first to draw attention to the problems caused by the mass use of lamps, later ecologists, and today medicine also warns of the negative effects of the mass use of lamps at night on human health. Exposure to artificial light interrupts the formation of the hormone melatonin, which makes such people more exposed to the dangers of various forms of cancer. Excessive use of lamps at night is also an important source of energy consumption. In Slovenia, we use an average of 83 kWh of electricity per inhabitant per year for public lighting, which is about twice as much as in Germany or the Netherlands. Of course, light pollution also affects ecosystems, especially nocturnal animals (insects, bats, etc.).

Public lighting lamps could be divided into three types according to their ecological suitability: unshielded, semi-shielded and shielded. The first two types of lamps are ecologically unsuitable, as they emit light just above the horizontal, which is the most problematic from the point of view of light pollution. Light that travels just above the horizontal travels the longest through the troposphere and thus leaves the greatest spatial effects. The modeling of this showed that the light emitted by lamps only 1° above the horizontal leaves the 5 km thick lower layer of the troposphere at a distance of 165 km, and the entire, about 10 km thick layer of the troposphere at a distance of 263 km. As a result, larger cities represent not only local but also regional sources of light pollution.

From the point of view of light pollution, the spectrum of bulbs in lamps is also important. According to Rayleigh's law, the scattering of light is inversely proportional to the fourth power of the wavelength. As a

result, blue light scatter sixteen times more intensely than red light. Lamps that have a radiation peak in the blue part of the spectrum (e.g. LED lamps) therefore cause greater spatial effects of light pollution than those that have a radiation peak in the orange part of the radiation (e.g. high-pressure sodium lamps). With the increased use of LED lamps, we can expect lower energy consumption, but on the other hand greater spatial effects, which will be the result of more intense scattering. In general, when thinking about night lighting, you should always ask yourself what, when and with what intensity to illuminate.

Light pollution could be defined as the emission of light from light sources that increases the natural illumination of the environment. Light pollution of the environment causes lighting disturbing to human vision and the feeling of glare in people, endangers traffic safety due to glare, direct and indirect radiation towards the sky disturbs the life or migration of birds, bats, insects and other animals, threatens the natural balance in protected areas, disturbs professional or amateur astronomical observation, or it consumes electricity unnecessarily by radiating towards the sky. Light pollution manifests as sky glow. This is the illumination of the night sky, which is caused by the scattering of light on the components of the atmosphere and is caused by lamps if, due to inadequate construction or incorrect installation, they emit light above the horizontal.

We measure the brightness of the sky with the Sky Quality Meter (SQM) manufactured by Unihedron, which represents the world's standardized way of measuring the brightness of the sky for the purposes of analyzing the level of light pollution. Measurement values are expressed in magnitudes per square arc second ($\text{mag}^2/\text{arc sec}$). The value means the brightness of a point on the sky that is $1'' \times 1''$, in magnitudes. Urban, heavily light-polluted areas are characterized by values of the order of 16 to 18 $\text{mag}^2/\text{arc sec}$, while darker locations are characterized by values of 22 $\text{mag}^2/\text{arc sec}$ and above. Measurements are made in clear weather and without the moon in the sky. Basic measurements are taken in the direction of the zenith.

Maribor, as the second largest Slovenian city with around 95000 inhabitants, is one of the major sources of light pollution in Slovenia, along with Ljubljana. As a regional source of light pollution, it is visibly recorded on a nighttime satellite image of Slovenia and the surrounding area (Figure 1). Due to the still prevailing non-ecological lighting, mainly due to unshielded and semi-shielded lamps, it creates a noticeable light dome in this part of Europe.

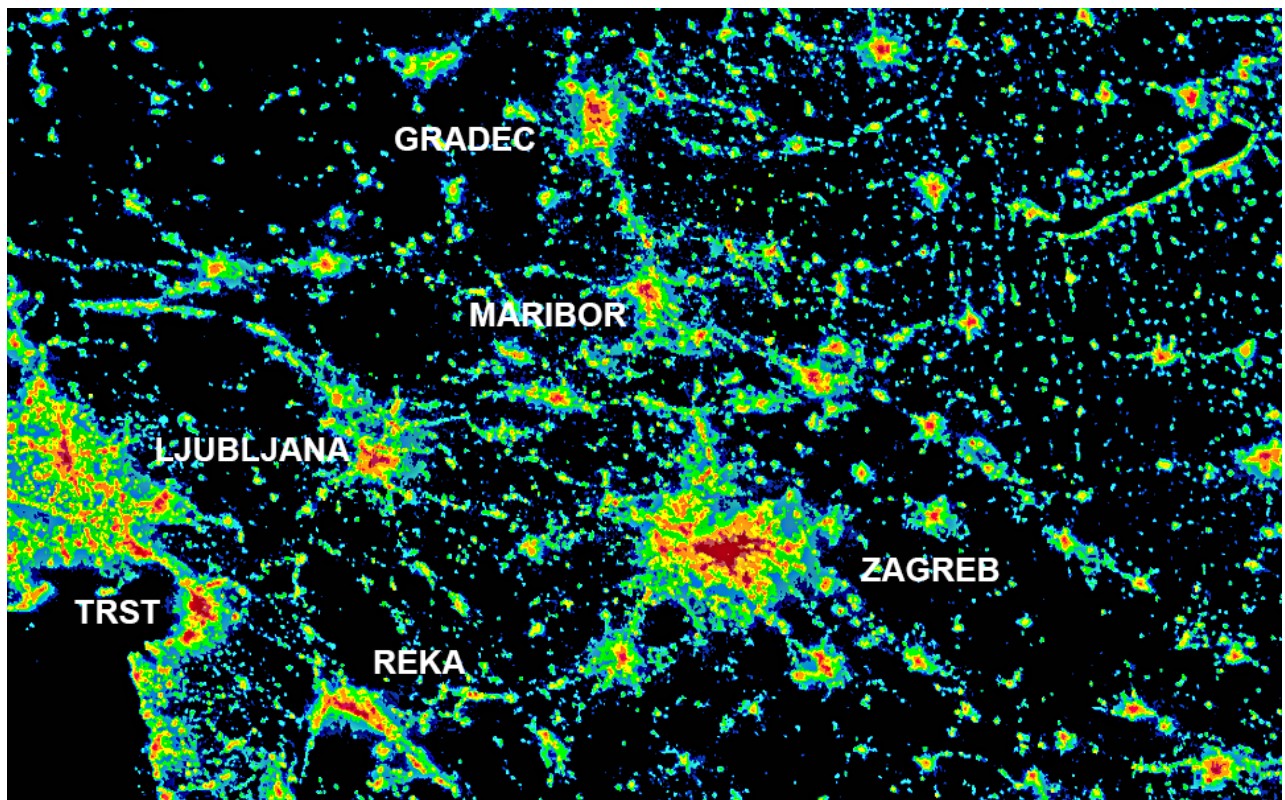
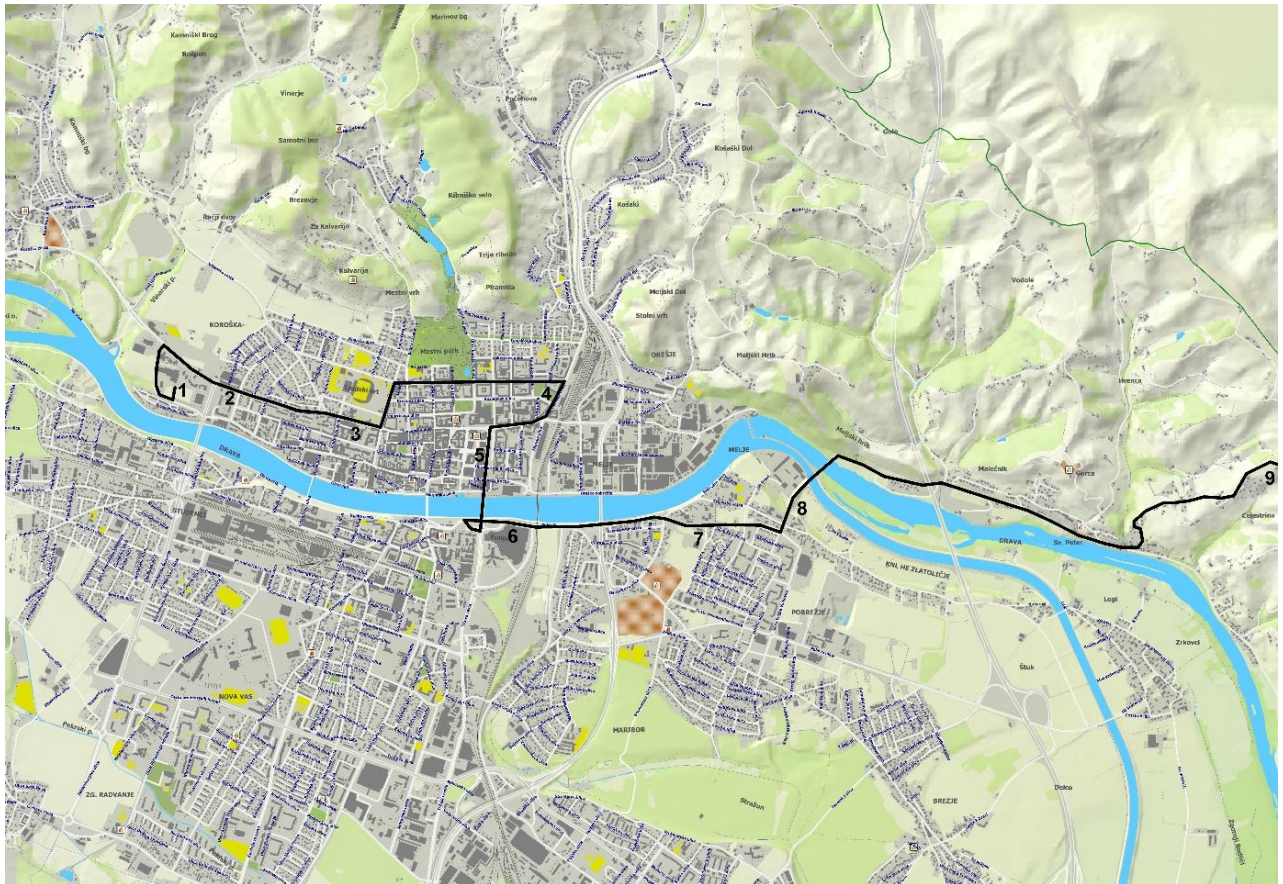


Figure 1: Sources of light pollution on the night satellite image of Slovenia and the wider surrounding area in 2016.

In our exercise, we will measure light pollution on the route between the center of the city of Maribor and its surroundings. The proposed measurement sites are marked on the map (Figure 2). Measurements are performed after dusk (in the true night), in cloudless weather and without the presence of the Moon in the night sky.

Figure 2: Measuring positions



Three measurements are made at each measuring point and the average value for this measuring point is calculated. The results are entered in Table 1.

Table 1: Sky Quality light pollution measurements (mag/sec²)

Location, date and time	Measurements in Zenith (mag/sec ²)
Average	

Average	
Average	
Average	
Average	
Average	
Average	

Average	
Average	

Are there differences in light pollution between the city centre and the surrounding area of Maribor and how large are these differences?

What is the cause of these differences?

Are there any differences between the city and its surroundings in the types of lamps (unshaded, semi-shaded, completely shaded (full cut-off))?

What types of lamps have you noticed along the way (high-pressure sodium lamps-orange light, mercury-blue light, LED lamps-"white" light). Write down what types of lamps dominate at each measuring site.

What do you think should be done to reduce light pollution? What can you do this way?

Activity 3 - Sound degradation of the environment

Theme	Sound degradation of the environment
Topic (Curriculum)	Elementary School: Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – settlements, Economy of Slovenia, Home region - geographical features, excursions GIM: Settlements, Energy and Industry, Sustainable Development, Slovenia - regional and environmental contradictions, excursions, etc.
Target group	ISCED2 (age: 14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	25 minutes of classroom preparation, 45 minutes of fieldwork, 20 minutes of synthesis outdoors or in the classroom
Cross-curricular links	Physics, mathematics, informatics
Organizational forms	Preparation - frontal work; implementation in the field - work in groups, synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet with map base, smartphone (mobile applications "Google maps" and "Sound Meter"), pen.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other area (we attach another map base and mark points where we expect different intensities of sound).
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital competences are required (working with mobile applications "Google maps" and "Sound Meter").
Objectives of the activity	<ul style="list-style-type: none"> - Orientation with the map and "Google maps" application; - measure and record the sound intensity at various measuring points in the settlement; - identify the main sources and types of sound and their impact on the quality of life in the settlement; - evaluate sound pollution in the selected area according to the scale of the impact of sound on human health; - propose measures to reduce or neutralize noise pollution in the selected settlement;

	- to evaluate the used methodology of sound degradation research.
Theoretical basis	<p>We know different types of sounds in the environment. We experience some as pleasant and others as unpleasant. Noise is a loud and unpleasant sound that can negatively affect the health and well-being of people and cause disturbances in the functioning of ecosystems. Sound is measured in decibels (dB).</p> <p>The term environmental degradation refers to the deterioration of the quality of the environment, which is often the result of human activity. Common forms of degradation are degradation of soil, atmosphere and water, and noise with its unpleasant sound represents a special form of degradation, called acoustic degradation.</p>
Conclusion (evaluation)	On the worksheet (part B), students evaluate the measured results and the research methodology. In the joint synthesis of the whole class, students compare the findings and suggestions for reducing sound degradation. They are planning a possible presentation of the results to the school or other public (poster, article for the school or local newspaper or radio, news on selected websites...).

Individual approach suggestions	Talented student	Less-gifted student
	They conduct research in a larger area.	They conduct research in a smaller area.
	They perform a more detailed analysis and prepare more in-depth proposals in step B.	In a heterogeneous group, they complete one element of the task.
	They organize and/or prepare a synthesis presentation of the results of the field assignment for the whole class (a poster for an exhibition, an article for the school or local newspaper or radio, news on selected websites)....	

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <ul style="list-style-type: none"> • explanation of theoretical foundations, • conducts a review of the worksheet with an emphasis on the map, 	<ul style="list-style-type: none"> • Get to know or refresh on the problem of sound degradation of the environment, • review the worksheet, the research route on the map and the required work procedures (install and review the "Google

	<ul style="list-style-type: none"> • guides the installation and review of the "Google maps" and "Sound Meter" applications, • guides the division of students into groups, • lead a conversation about the safety plan. 	maps" and "Sound Meter" applications), <ul style="list-style-type: none"> • divide into groups, • get to know and co-create the rules of safe research on the streets.
task 2	Leads the students to starting point A.	Orient themselves with a map and activate the "Google maps" application, prepare for field work.
task 3	Monitors the work of the groups and advises if necessary.	In groups, they perform sound measurements at measurement points and identify the sources of sounds. They fulfill Table 1.
task 4	Monitors the work of the groups and advises if necessary.	In groups, they perform step B on the worksheet (draw a conclusion about the sound degradation of the selected environment and its impact on health, propose possible solutions to reduce possible sound degradation, evaluate the research methodology).
task 5	Leads the synthesis, derivation of final substantive conclusions and the plan for further work.	The groups present the results of the work (worksheet solutions). They compare and generalize the results with an emphasis on proposed solutions. They make a plan for a possible presentation of the results to the school or other public.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed. If there are several groups, we ensure that they are at a suitable distance at the measurement points, so that they do not affect the measurement results by causing noise.
Note: /		

Key to the worksheet: /

SOUND DEGRADATION OF THE ENVIRONMENT

A

On the map, the starting point of the field work (*Glavni trg, Maribor*) is marked with the letter A, and the measuring points are marked with numbers: 1 (*in front of the Luft 360 pub*), 2 (*Grajski trg*) and 3 (*Rožni grič, city park*).

Figure 1: The map shows the collection point A and measuring points in Maribor.



o Use the "Google maps" application to get from point A to measuring points 1, 2 and 3. At each point or measurement point (1, 2, 3) use the "Sound Meter" app to measure the sound/noise level.

o Measurement with the "Sound Meter" application: a member of the group places the phone in the palm of the hand with the phone's microphone pointing away from the person(s). During the measurement,

you and your classmates must be quiet so that your sounds do not disturb the measurements of the sounds in the environment.

o Each measurement should last one minute. After stopping each measurement, record the average result in Table 1.

o At each measurement point, try to identify the main sources of sound/noise in the environment. Identify natural and man-made sources and write them in Table 1.

Table 1: Measurement results

	Sound / noise (dB)	Main noise sources (natural, artificial)
Measuring point 1		
Measuring point 2		
Measuring point 3		


B

Thinking about it...

1 Compare the results of measurements at all measuring points. Which measuring point (1, 2 or 3) was the least and which the most noisy?

2 Which reasons affect the differences in noise between the measuring points?

3 What impact does the behavior of the researcher have on the measurements and what the choice of the mobile application?

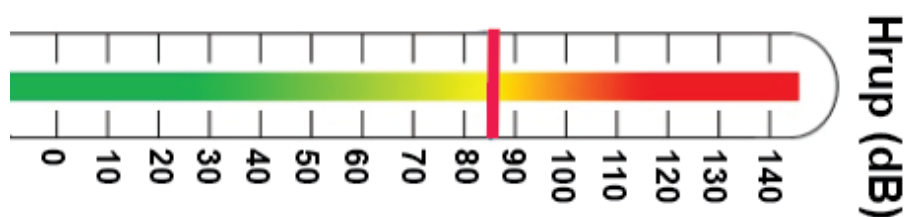
	Short description 
Researcher impact	

Mobile application impact	
How to improve reliability of measurements?	

4 Can the noise at measuring points 1,2,3 be harmful to human health?

Figure 2: A scale showing the danger of noise at a certain volume for human health.

The limit value at which noise becomes dangerous to health is 85 dB.



5 Which can be the effects of the sound degradation on geographical area (for example on spatial development of the city)?

6 What actions could be taken to reduce the sound degradation in the city?

List some actions:

Describe one action in more detail:

And for the end.... think of some of your favorite sounds in the city ... which are they? 😊



Activity 4 - Visual degradation of the environment

Theme	Visual degradation of the environment
Topic (Curriculum)	Elementary School: Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – settlements, Economy of Slovenia, Home region - geographical features, excursions
	GIM and other secondary schools: Settlements, Energy and Industry, Sustainable Development, Slovenia - regional and environmental contradictions, excursions, etc.
Target group	ISCED2 (age: 14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	25 minutes of classroom preparation, 90 minutes of fieldwork, 45 minutes of synthesis in the classroom
Cross-curricular links	Art education, psychology, sociology, informatics
Organizational forms	Preparation - frontal work; implementation in the field – individual work and work in groups, synthesis – frontal, group work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet with map base, smartphone (mobile application "Google maps", camera), pen.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other area (we attach another map base and mark points where we expect different cases of visual degradation).
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital competences are required (working with mobile application "Google maps", camera).
Objectives of the activity	<ul style="list-style-type: none"> - Orientation with the map and the "Google maps" application via the QR code; - feel and evaluate the harmony or visual degradation of the environment; - think about the factors that influence the harmony or visual degradation of the environment; - think about the effects of harmonious and visually degraded environments on people, the use of space and spatial development; - identify and photograph cases of visual degradation; - propose measures to reduce or neutralize visual degradation in the

	<p>selected settlement;</p> <ul style="list-style-type: none"> - develop ideas for visual degradation research.
Theoretical basis	<p>By visual degradation we have in mind nything that disturbs the aesthetics / harmony of the appearance of a certain area (or contradicts the aesthetics of nature). Visually degraded areas are those areas where the encroachment on space has negatively affected the appearance of the area or the area is untidy and neglected due to abandoned activity. The degraded area gives the impression of an uncultured and indifferent attitude towards the environment.</p> <p>Examples of visual degradation:</p> <ul style="list-style-type: none"> - decaying objects - outstanding objects (eg transmitters) - graffiti - transport infrastructure - construction sites - billboards - waste - abandoned buildings - car parks - trash cans..
Conclusion (evaluation)	<p>In the joint synthesis of the whole class, students compare the results of the worksheet and present photographic examples of visually degraded areas of the selected settlement. They are planning a possible presentation of the results to the school or other public (poster, article for the school or local newspaper or radio, news on selected websites...).</p>

Individual approach suggestions	Talented student	Less-gifted student
	They conduct research in a larger area.	They conduct research in a smaller area.
	They perform a more detailed analysis and prepare more in-depth proposals.	In a heterogeneous group, they complete one element of the task.
	They organize and/or prepare a synthesis presentation of the results of the field assignment for the whole class (a poster for an exhibition, an article for the school or local newspaper or radio,	

	news on selected websites)...	
--	-------------------------------	--

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <ul style="list-style-type: none"> • explanation of theoretical foundations, • conducts a review of the worksheet with an emphasis on the map, • guides the installation and performance review of applications for opening QR codes and "Google maps", • guides the division of students into groups, • lead a conversation about the safety plan. 	<ul style="list-style-type: none"> • Spoznajo ali osvežijo problematiko vizualne degradacije okolja, • pregledajo delovni list, pot raziskovanja na karti in zahtevane postopke dela (namestijo in pregledajo aplikaciji za odpiranje QR kode in "Google maps"), • se razdelijo v skupine, • spoznajo in sooblikujejo pravila varnega raziskovanja na ulicah.
task 2	Leads the students to starting point.	They prepare for field work. They renew the rules of work.
task 3	Monitors the work of the groups and advises if necessary. After work, he receives all groups at the starting point. Direct them to further work.	The groups are distributed around the park. Individuals in each group first do part A in the worksheet - individual work, then the group gathers again for a reflection. Through these organizational forms of work, the perception and thinking about visually harmonious spaces and the criteria for defining these takes place.
task 4	It accompanies students on their way to the next point.	During the journey to the next point, they identify and photograph examples of a visually degraded environment (step B on the worksheet).
task 5	Monitors the work of the groups and advises if necessary.	Individually and in groups, they perform step C on the worksheet (perceiving and thinking about visually degraded environments, the criteria for defining these, the causes and consequences of different expressions of visibility in environments, and form ideas for ways of researching visually degraded environments).
task 6	Leads the synthesis, derivation of final substantive conclusions and the plan for further work.	The groups present the results of the work (worksheet solutions). They show photos of elements of visual degradation taken in the field. They compare and generalize the results with an emphasis on proposals for researching the elements of visual degradation of environments. They make a

		plan for a possible presentation of the results to the school or other public.
Implementation risks	A preparatory conversation about safe research on the streets (safety plan) is needed.	
Note: /		

Key to the worksheet: /

Visual degradation of the environment

A



Figure 1: City park Maribor

Individual work

1 Find a space in the park that you experience as harmonious. When you settle in this space, allow yourself to "open" your senses, that is: to hear (*sounds, noises, silence...*), to see (*colors, objects, plants...*), to feel on the skin (*moisture, temperature, wind...*). After a while, write down the three natural and three social elements of the landscape that you notice.

Natural-geographical elements of the landscape:

-
-

-

Socio-geographical elements of the landscape:

-

-

-

2 Describe the relationship between the natural and social elements of this landscape (*their quantity, their complementarity or exclusion, does the relationship between them changes over time - eg during the day*).

Write down your feelings in this space.

3 What would **You** say: when is a space harmonious (by what criteria can harmonious spaces be defined)?

Group chat

Compare your notes with other group members and form conclusions (is the perception of harmony in the environment subjective?).

B



Take a picture of me and find the next stop!

OB ŽELEZNICI 16

2000 MARIBOR

Observe the landscape along the way and photograph examples of visual degradation that you recognize in space.

C



Figure 2: Pekarna Maribor

Individual work

1 Find space for yourself. When you settle in this space, allow yourself to "open" your senses, that is: to hear (*sounds, noises, silence...*), to see (*colors, objects, plants...*), to feel on the skin (*moisture,*

temperature, wind...). After a while, write down the three natural and three social elements of the landscape that you notice.

Natural-geographical elements of the landscape:

-
-
-

Socio-geographical elements of the province:

-
-
-

2 Describe the relationship between the natural and social elements of this landscape (*their quantity, their complementarity or exclusion, does the relationship between them changes over time - eg during the day*).

Write down your feelings in this space.

3 What would **You** say: when is a space visually degraded (by what criteria can visually degraded spaces be defined)?

4 Write down some effects of visual degradation on man and on geographical space (eg spatial planning, spatial development planning).

Group chat

Compare your records in the group. Draw conclusions (is visual degradation a subjective category?).

What factors affect the harmony or to the visual degradation of the environment?

Suggest some ways in which visual degradation of the environment could be researched.

Activity 5 - Intergenerational cooperation or “together we are strong”

Theme	Intergenerational cooperation or “together we are strong”
Topic (Curriculum)	Elementary School: Orientation, Life on the mainland, Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – settlements, population, traffic, Home region - geographical features; Excursions
	GIM and other secondary schools: Settlements, Population, Traffic, Sustainable Development, Slovenia - regional and environmental contradictions, Regional Geography of Slovenia-excursions.
Target group	ISCED2 (age: 11-14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	10 minutes of preparation, 45 minutes of fieldwork, 10 minutes of synthesis outdoors or in the classroom
Cross-curricular links	Ethics and civic education, Sociology
Organizational forms	Preparation - frontal work; implementation in the field - work in pairs, synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet, smartphone (mobile application "Google my map"), pen.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other area (we attach another map base and form another “Google my map”).
Environment’s specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital competences are required (working with mobile application "Google my map").
Objectives of the activity	<ul style="list-style-type: none"> - Develop a sense of co-responsibility in solving problems of life in the community, for intergenerational cooperation and empathy for vulnerable social groups (one of the aims of sustainable development); - orientation with the map and “Google my map” application; - identify obstacles in the centre of the city that are problematic for people with reduced mobility (the elderly, people in wheelchairs, people with crutches and other technical aids in walking); - photograph obstacles and place them on the map with the help of “Google my map” - create a joint map (collaborative mapping); - interpret the problems and spatial location of obstacles for the people with

	reduced mobility and propose solutions.
Theoretical basis	The key needs of sustainable living on the planet are: reducing consumption (developing a circular economy), pollution control, protection of habitats/living environments and quality coexistence. These needs are covered in the 17 Sustainable Development Goals adopted at the UN Sustainable Development Summit as the 2030 Agenda for Sustainable Development. One of the goals is the reduction of inequality, which is the basis of quality coexistence, to which this field assignment contributes. Inequality is also expressed through unequal opportunities to access desired locations. Elderly persons, persons in wheelchairs or persons with other mobility impairments cannot independently carry out life's obligations if they encounter infrastructural obstacles. This reduces their quality of life, and the problem can be wider. Intergenerational cooperation manifests itself as recognition of living obstacles, empathetic understanding of the physically challenged and joint solving of living issues.
Conclusion (evaluation)	On the worksheet (part C), students evaluate the collected data. In the joint synthesis of the whole class, the students examine the common map, the spatial distribution of various obstacles and propose solutions for the spatial development of the city with the aim of reducing inequalities and increasing intergenerational cooperation. They are planning a possible presentation of the results to the school or other public (poster, article for the school or local newspaper or radio, news on selected websites...).

Individual approach suggestions	Talented student	Less-gifted student
	They conduct research in a larger area.	They conduct research in a smaller area.
	They perform a more detailed analysis and prepare more in-depth proposals in step B.	In a heterogeneous group, they complete one element of the task.
	They organize and/or prepare a synthesis presentation of the results of the field assignment for the whole class (a poster for an exhibition, an article for the school or local newspaper or radio, news on selected websites)....	

Activity scenario	Teacher activities	Students' activities
-------------------	--------------------	----------------------











task 1	<p>Preparation for field work:</p> <ul style="list-style-type: none"> • explanation of theoretical foundations, • guides the division of students into pairs, • leads a review of the worksheet and marking of the default research areas - so that the pairs work in different locations - together they cover a larger part of the city, • shares the link on "Google my map", and leads a review of the application (the link to "my map" should be created before that), • leads a conversation about the safety plan. 	<ul style="list-style-type: none"> • They become aware of the role of intergenerational cooperation as an element of sustainable development, • examine the worksheet, pairs mark the research area, • use the link and check the operation of the "Google my map" application, • get to know and co-create the rules of safe research on the streets.
task 2	Monitors the work of the pairs and advises if necessary.	In pairs, they carry out step B - research of the selected area. They identify, photograph and enter data into "Google my map" so that they place the point at the location where they identified the obstacle and use the appropriate symbol from the legend. In that way they create a common map of obstacles for people with reduced mobility.
task 3	Monitors the work of the pairs and advises if necessary.	In pairs, they perform step C - they draw a conclusion about the spatial distribution of obstacles - where there are the most and where the fewest, etc. and propose possible solutions for planning the development of the city).
task 4	Leads the synthesis, derivation of final substantive conclusions and the plan for further work.	The entire group examines the shared joint map in "Google my map". They draw a conclusion about the spatial distribution of obstacles in the entire considered area of all pairs - where there are the most and where the least, etc. and propose possible solutions for planning the development of the city. They make a plan for a possible presentation of the results to the school or other public.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.
<p>Notes:</p> <ul style="list-style-type: none"> • The exercise can be done only using the "Google my map" application or using a physical worksheet or a combination of both approaches. • It is good to create a common legend at the beginning of the work for entering obstacles for people with reduced mobility on the map - a suggestion of a legend for "Google my map" among the notes to the 		

worksheet. This will make the joint final map faster.

- In case of internet problems, students can use the physical map in the field and transfer the data to a shared physical or electronic map in class.

Key to the worksheet:

Proposal for a unified legend for the "Google my map" application (the icons are taken from the list of favorites for easier selection in the field).

<input checked="" type="checkbox"/>	Stairs	⋮
	 Posamezni slogi	
	 Stairs	
<input checked="" type="checkbox"/>	Pavement edge	⋮
	 Posamezni slogi	
	 Pavement edge	
<input checked="" type="checkbox"/>	Steep path	⋮
	 Posamezni slogi	
	 Steep path	
<input checked="" type="checkbox"/>	Macadam	⋮
	 Posamezni slogi	
	 Macadam	
<input checked="" type="checkbox"/>	Pavers (concrete, stone)	⋮
	 Posamezni slogi	
	 Pavers	

Intergenerational cooperation or “together we are strong”



A

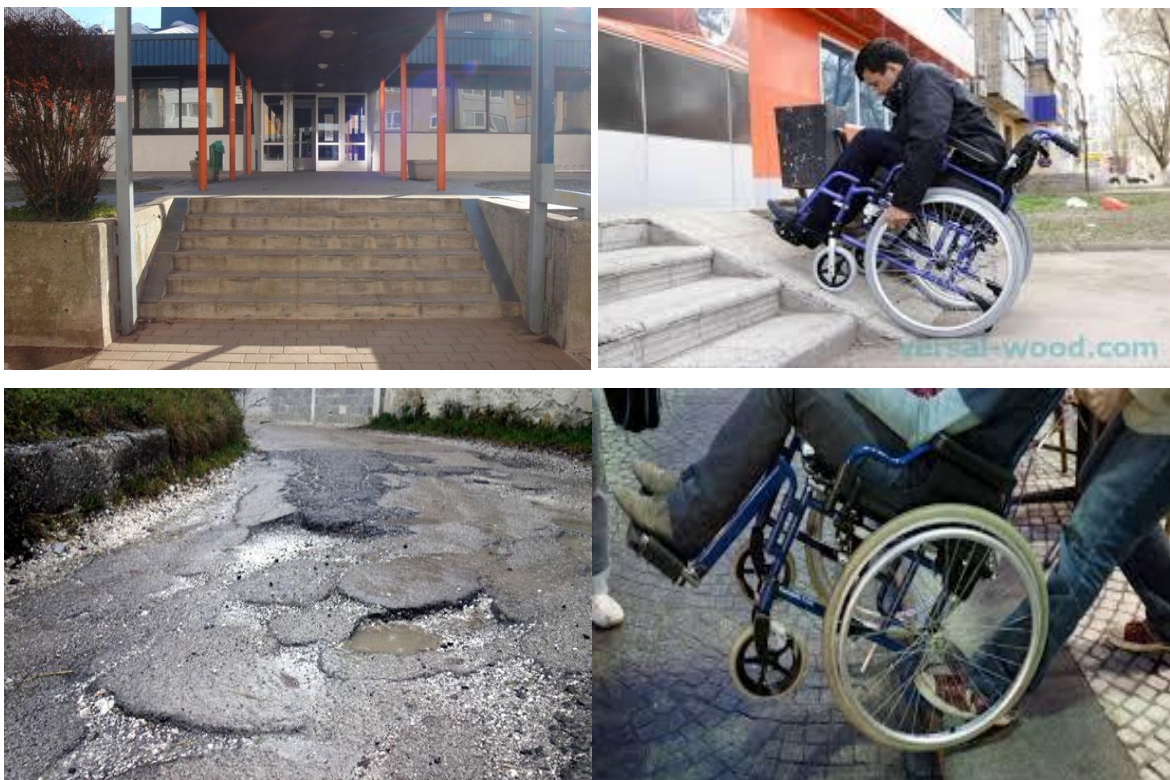
Mark your mapping area (suggestion: each pair should walk 0.5 km down the selected street in the centre of the city).



B

When you notice an obstacle, which in your opinion, could be an obstacle to the movement of persons with reduced mobility (**stairs, high edges of sidewalks, steep paths, untidy macadam or paving stones, etc.**), photograph it and mark it on joint map in „Google my map“. Use the suggested legend. You can also mark the obstacles on the map on this worksheet.

Some examples of obstacles:



C

Let's think about it...

1 What obstacles did you notice in the selected area? What obstacles prevail in the selected area?

2 Why do You think these obstacles are problematic in this area?

3 How could these obstacles be regulated so that they no longer restrict the persons with reduced mobility? How can you contribute to resolving this issue?

Activity 6 - Mindfulness to enhance (geographic) curiosity

Theme	Mindfulness to enhance (geographic) curiosity
Topic (Curriculum)	Elementary School: <i>we use the exercise whenever we want to strengthen students' spatial perceptions and well-being</i>
	GIM and other secondary schools: <i>we use the exercise whenever we want to strengthen students' spatial perceptions and well-being</i>
Target group	ISCED2 (age: 11-14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	5 minutes of preparation, 30-45 minutes of fieldwork, 5-10 minutes of synthesis outdoors or in the classroom
Cross-curricular links	Psychology, biology...
Organizational forms	Preparation - frontal work; implementation in the field – individual work and work in groups, synthesis – work in groups
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet, smartphone (mobile applications and internet), pen.
Place of realisation	The task should be carried out in nature (urban parks, rural areas). The chosen area should allow a certain level of intimacy (hidden corners behind trees, suitable distance from densely populated parts of the settlement...).
Environment's specifics	

Required entry knowledge and skills of students	It is necessary to emphasize the importance of the technique of performing tasks, i.e. that it is necessary to perform simple tasks mindfully/consciously/with mental presence. The emphasis is not on the content, but on the authenticity of the experience.
Objectives of the activity	<ul style="list-style-type: none"> - To be calmly present, - feel yourself and the environment, - form a question about yourself or the environment (or anything that comes to our mind during the exercise) or not; - find the answer to this question (or not).
Theoretical basis	In an age of saturation with information and obligations, a common consequence is a decline in genuine wonder, curiosity and life and work motivation. There are several ways of strengthening the latter and our well-being. One way is mindfulness. Mindfulness is the awareness that comes from paying attention in a particular way: on purpose, in the present moment, and without judgment. It is an open, kind, non-judgmental awareness of the present moment. It occurs when we are fully here and

	now in our experience (I drink water and I KNOW I'm drinking water. I look at clouds and I KNOW I look at clouds. I listen to crickets and I KNOW I listen to crickets). (Kabat-Zinn, Kornfield, Brach, Nhat Hanh). When we allow ourselves to be peacefully in Simplicity, genuine curiosity, wonder and (geographical) questions about living and the world begin to arise. These can be the beginning of a new internally motivated interdisciplinary research.
Conclusion (evaluation)	The teacher approaches the evaluation by groups - with respect for the possible very diverse (positive or negative) individual and group dynamics. In this case, evaluation is meant as a possible exchange of feelings after the exercise has been carried out and an exchange of possibly generated substantive questions and answers or plans for obtaining answers (that is, research ideas), but the latter is not the main goal, rather a possible by-product.

Individual approach suggestions	Talented student	Less-gifted student
It is necessary to be sensitive to the possible diverse experience of the exercise and to accept this diversity.		

Activity scenario	Teacher activities	Students' activities
task 1	Preparation for field work: presents a worksheet with a special emphasis on the method of performing the technique of conscious perception of oneself and the environment and its purpose (strengthening well-being, connection with the environment and possibly awakening curious questions and non-binding search for answers or thinking about ways to get answers). Content is secondary, conscious experience is primary.	They get to know the mindfulness technique and its purpose. They review the worksheet and learn how to work.
task 2	Leads students to a suitable natural environment. Ensures safety and compliance among field task operators. It proposes a norm of division into groups.	They are divided into groups according to their own wishes, taking into account the basic norms. The groups distance themselves from each other.

task 3	He is present at a suitable distance, does not interfere with the work of groups.	Each group splits up. Individual implementation of part B (20 minutes).
task 4	He is present at a suitable distance, does not interfere with the work of groups.	The group reunites - they perform step C, i.e. individuals exchange their feelings while doing part B. They write down any questions that arise about any content.
task 5	He is present at a suitable distance, does not interfere with the work of groups.	Doing Step D - finding answers to questions or talking about how you might get answers.
task 6	Conducts a conversation about the field exercise - in groups or individually or in the whole class (depending on the perception of the results of the exercise). It collects questions, encourages further research, the search for answers.	Exchange of impressions and examination of curious questions in groups, individually or in the whole class.
Implementation risks		Individual performance in Step B can allow awareness of more difficult emotions. We notice them and allow them.
Notes: It makes sense to read the worksheet in its entirety before implementing it and then do the exercises practically. No exact sequence of exercises within each step on the worksheet is required.		

Key to the worksheet: /

MINDFULNESS

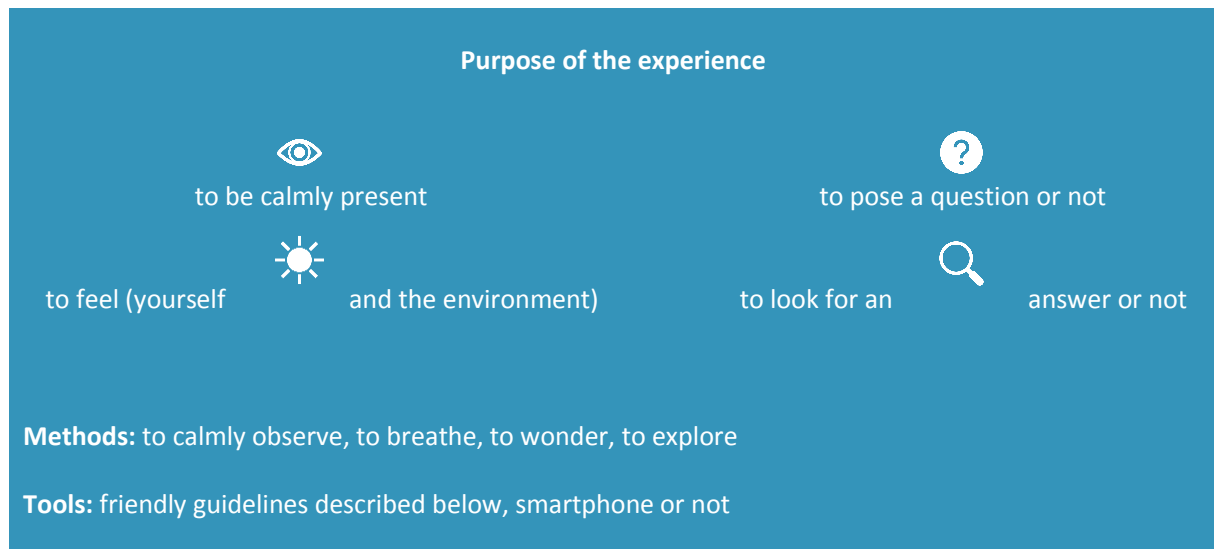
...The most sincere and simple Curiosity happens within us, out of Simplicity...

Mindfulness is **AWARENESS** that we get by paying attention in a certain way: **intentionally**, in the **present moment** and **without judgment**. *It is a open, friendly, non-judgmental awareness of the present moment*. It arises when we are completely here and now with our experience (I drink water and *I know* I drink water; I look at the clouds and *I know* I look at the clouds; I listen to crickets and *I know* I listen to crickets)

(Kabat-Zinn, Kornfield, Brach, Nhat Hanh).

Very curious? You can click on:

<https://www.apa.org/monitor/2012/07-08/ce-corner>.



Follow A to D or do something similar Your way...

A.

If you are in a city, find a park, an island of peace in an urban environment. If you are out of town, find an intimate corner in nature.



B.

An independent mindfulness experience (app. 20 minutes)

1

Find a safe and intimate place. Take 5 slow and deep breaths, so you **F E E L** the air traveling in and out of you.

2

Pick up a small stone or piece of grass or... **O B S E R V E** it with wonder and curiosity - **AS IF YOU SEE IT FOR THE FIRST TIME** (shapes, colors, surfaces, touch, smells...)

3

Rotate very slowly around Your axis. Which colors predominate?

Look at the sky. Which color prevails?

Look at the ground. Which color predominates now?

Can you feel the wind on your skin?
Do you feel the heat of the sun or the cold air or the drops on your face?

Open your hearing to the whole space. What do you hear?

How does the air smell right now?

What's all alive around you?
Hug the nearest tree. How do You feel about it?
Choose two leafs. Compare them (similarities, differences).

C.

Togetherness

Sit together or take a slow walk - the whole group. Take a photo of You.

Compare your answers from Part B.

What are you wondering just now, at this very moment? Write down your question(s).

D.

Curiosity

Are there any questions you very much want to find answers to? If yes, try to do it. If You need help, use mobile apps as listed below or other ways to find the credible answer:

- | | |
|----------------|-----------------|
| ▪ Google Lens | ▪ Rockd |
| ▪ Google Earth | ▪ Sun Position |
| ▪ ARuler | ▪ GPS Waypoints |
| ▪ PlantNet | ▪ Star Walk 2 |

What did you discover? What are the benefits of mindful experiences?

Share your experience. Simple 😊

Activity 7 - But where in the toti Maribor (Urban tourist visit planner)

Theme	But where in the "toti" Maribor? (Urban tourist visit planner)
Topic (Curriculum)	Elementary School: Regional Geography, Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – settlements, tourism, home region - geographical features, excursions
	GIM and other secondary schools: Settlements, Tourism, Sustainable Development, Regional Geography (Europe, World, Slovenia), Slovenia - regional and environmental contradictions, excursions.
Target group	ISCED2 (age: 14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	45 minutes of preparation, 75 minutes of fieldwork, 60 minutes of synthesis outdoors
Cross-curricular links	History, biology, sociology, ethics and civic education, mathematics, informatics
Organizational forms	Preparation - frontal work, group work (groups marked with letters A,B,C,D,E); implementation in the field – group work (groups by letters), synthesis - group work (groups by numbers; 1,2,3,4,5) <i>* The groups are formed according to the principles of cooperative learning, the goal of which is to achieve the activity and responsibility of each individual student. The teacher prepares slips - each slip has a letter and a number (eg A1, A2, A3, A4, A5; B1, B2,...; C1, C2...). Each student draws one slip - his first group, in which he will do field work preparation and field work, is marked with a letter, and the second group, in which he will do field work synthesis, is marked with a number.</i>
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet, smartphone (stopwatch, calculator, mobile applications "Google my map", "Google Lens"), pen.
Place of realisation	The task is prepared for the Maribor area. It can be adapted to any other area. In the case of the regional geography of other regions (Europe, the World, Slovenia), a more comprehensive, applied (geographical) knowledge of the areas is possible with the exercise. Instead of Google Lens, we use Google Earth/Google Street view in combination with a web browser. In the case of regional geography of foreign areas, a combination of cabinet study of foreign regions and comparison with field work in the home region (tourism potentials) is possible.
Environment's specifics	

Required entry knowledge and skills	Substantive preparation for field work is required. Basic digital skills are required (working with a stopwatch, calculator, mobile applications "Google
-------------------------------------	--

of students	my maps" and "Google Lens").
Objectives of the activity	<ul style="list-style-type: none"> - They work with the application "Google my maps" (point entries, route entries, route measurement...); - orient themselves and move in the field with a map; - develop competences in the acquisition, analysis and synthesis of textual information based on the use of "Google Lens"; - get to know the tourist (geographical) potential of the selected area; - supplement the textual information with the interview method; - point out the factors and issues of tourist planning; - evaluate the applicability of geographical knowledge in tourism planning; - prepare the itinerary of the tourist route.
Theoretical basis	When planning tourist visits to selected locations, several factors must be taken into account (tourist potential - natural and cultural heritage, areas of interest for tourists, distances, time, rest, food, overnight stays...). In this planning, the geographical content of the chosen location and geographical competences are very directly expressed, thus demonstrating the practical utility value of geography. In this way, students become familiar not only with the geographical elements of the area, but also experience the value of geographical methodology.
Conclusion (evaluation)	Preparation and fieldwork are done in groups formulated on the basis of letters. Synthesis takes place in groups formulated on the basis of numbers. In the synthesis, each student presents the results of the field work and group uses the knowledge gained through experience from the preparation and the field to create their own tourist plan. The plan of the tourist visit is posted on the class bulletin board.

Individual approach suggestions	Talented student	Less-gifted student
By its very nature, collaborative learning means the integration of all students, who prepare in groups and then report the pre-prepared topic individually in newly formed groups. Practicing responsibility is essential.		



Activity scenario	Teacher activities		Students' activities
task 1	Preparation for field work: <ul style="list-style-type: none">• explanation of theoretical foundations,• explains the cooperative learning method and guides the division of students into groups based on letters and predicts synthesis in groups based on numbers,• conducts a review of the worksheet and necessary applications,• lead a conversation about the security plan,• advises, if necessary, in the preparatory work of the groups.		<ul style="list-style-type: none">• get to know the goals and methods of work,• review the worksheet and necessary applications, divide into groups,• get to know and co-create the rules of safe research on the streets,• in groups (by letter) they choose the points they will visit and plan the course and time of the journey with Google my maps.
task 2	Monitors the work of groups and advises if necessary.		They carry out field work (groups by letters): using Google my maps, they visit selected points and briefly describe them using Google Lens. Through their own thinking and an interview, they evaluate the importance of the selected tourist potentials.
task 3	Monitors the work of groups and advises if necessary.		The groups gather at the end point and are redistributed into new groups formulated by numbers. Individuals report results.
task 4	Monitors the work of groups and advises if necessary.		Based on what they have learned, the groups create their own tourist plan (itinerary). When they return to the classroom, they post the completed plan on the bulletin board.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.	
Notes: It is very important that the students get to know the content objectives of the work and, in particular, the methodology and meaning of collaborative learning.			

Key to the worksheet:

But where in the “toti” Maribor? (Urban tourist visit planner)

Group A

Field preparation:

Mark five sacred sights of Maribor on the map of group A (Google my maps). Mark/add the walking route () and measure it () using the appropriate tools on the map of group A (Google my maps). Calculate how much time a tourist would need to see the selected sacred sights if he were to move at a speed of 5 km/h.

A tourist would need _____ minutes.

Fieldwork:

Visit all five points in the fieldwork. Use a stopwatch to measure the duration of your journey from point to point. Take a photo of each point with the Google Lens mobile application and write down some of the main features (at least three) that may be of interest to tourists. Plan the notes together, but each member of the group should write them in their own worksheet.

Plenty of pleasure on the way and a successful rescue.

SACRAL SIGHTS

a)

Point 1 (name): _____

Description:

Coordinates: _____

Point 2 (name): _____

Description:

Coordinates: _____

Point 3 (name): _____

Description:

Coordinates: _____

Point 4 (name): _____

Description:

Coordinates: _____

Point 5 (name): _____

Description:

Coordinates: _____

b)

How long did it take you to complete the journey? _____

Compare this measurement of time with the calculation of the time it would take a tourist to travel, which you made before the fieldwork using Google my maps. What did you find out?

c) Stop a random passer-by and ask him what significance sacred sights have for him and what he thinks they have for the city of Maribor and its tourism? Write down his answer.



d) Using GPS, go to the location with the coordinates: 46°33'53.4"N 15°38'55.9"E

Here you will reassign yourself to new groups, marked with numbers, and briefly present the results to the members of the new group.

But where in the “toti” Maribor? (Urban tourist visit planner)

Group B

Field preparation:

Mark five cultural sights of Maribor on the map of group B (Google my maps). Mark/add the walking route () and measure it () using the appropriate tools on the map of group A (Google my

maps). Calculate how much time a tourist would need to see the selected cultural attractions if he were to move at a speed of 5 km/h.

A tourist would need _____ minutes.

Fieldwork:

Visit all five points in the fieldwork. Use a stopwatch to measure the duration of your journey from point to point. Take a photo of each point with the Google Lens mobile application and write down some of the main features (at least three) that may be of interest to tourists. Plan the notes together, but each member of the group should write them in their own worksheet.

Plenty of pleasure on the way and a successful rescue.

CULTURAL SIGHTS

a)

Point 1 (name): _____

Description:

Coordinates: _____

Point 2 (name): _____

Description:

Coordinates: _____

Point 3 (name): _____

Description:

Coordinates: _____

Point 4 (name): _____

Description:

Coordinates: _____

Point 5 (name): _____

Description:

Coordinates: _____

b)

How long did it take you to complete the journey? _____

Compare this measurement of time with the calculation of the time it would take a tourist to travel, which you made before the fieldwork using Google my maps. What did you find out?

c) Stop a random passer-by and ask him what significance do cultural attractions have for him and what does he think of the city of Maribor and its tourism? Write down his answer.



d) Using GPS, go to the location with the coordinates: 46°33'53.4"N 15°38'55.9"E

Here you will reassign yourself to new groups, marked with numbers, and briefly present the results to the members of the new group.

But where in the “toti” Maribor? (Urban tourist visit planner)

Group C

Field preparation:

Mark five natural attractions of Maribor on the map of group C (Google my maps). Mark/add the walking route () and measure it () using the appropriate tools on the map of group A (Google my maps). Calculate how much time a tourist would need to see the selected sacred sights if he were to move at a speed of 5 km/h.

A tourist would need _____ minutes.

Fieldwork:

Visit all five points in the fieldwork. Use a stopwatch to measure the duration of your journey from point to point. Take a photo of each point with the Google Lens mobile application and write down some of the main features (at least three) that may be of interest to tourists. Plan the notes together, but each member of the group should write them in their own worksheet.

Plenty of pleasure on the way and a successful rescue.

NATURAL ATTRACTIONS

a)

Point 1 (name): _____

Description:

Coordinates: _____

Point 2 (name): _____

Description:

Coordinates: _____

Point 3 (name): _____

Description:

Coordinates: _____

Point 4 (name): _____

Description:

Coordinates: _____

Point 5 (name): _____

Description:

Coordinates: _____

b)

How long did it take you to complete the journey? _____

Compare this measurement of time with the calculation of the time it would take a tourist to travel, which you made before the fieldwork using Google my maps. What did you find out?

c) Stop a random passer-by and ask him what significance natural attractions have for him and what he thinks they have for the city of Maribor and its tourism? Write down his answer.



d) Using GPS, go to the location with the coordinates: 46°33'53.4"N 15°38'55.9"E

Here you will reassign yourself to new groups, marked with numbers, and briefly present the results to the members of the new group.

But where in the "toti" Maribor? (Urban tourist visit planner)

Group D

Field preparation:

On the map of group D (Google my maps), mark five locations in Maribor where you can eat (restaurants, pizzerias...). Mark/add the walking route () and measure it () using the appropriate tools on the map of group A (Google my maps). Calculate how much time a tourist would need if he wanted to visit all these points and was moving at a speed of 5 km/h.

A tourist would need _____ minutes.

Fieldwork:

Visit all five points in the fieldwork. Use a stopwatch to measure the duration of your journey from point to point. Take a photo of each point with the Google Lens mobile application and write down some of the main features (at least three) that may be of interest to tourists. You can also obtain information in other ways. Plan the notes together, but each member of the group should write them in their own worksheet.

Plenty of pleasure on the way and a successful rescue.

WHERE TO EAT (RESTAURANTS, PIZZARIES...)?

a)

Point 1 (name): _____

Description:

Coordinates: _____

Point 2 (name): _____

Description:

Coordinates: _____

Point 3 (name): _____

Description:

Coordinates: _____

Point 4 (name): _____

Description:

Coordinates: _____

Point 5 (name): _____

Description:

Coordinates: _____

b)

How long did it take you to complete the journey? _____

Compare this measurement of time with the calculation of the time it would take a tourist to travel, which you made before the fieldwork using Google my maps. What did you find out?

c) Stop a random passer-by and ask him what significance do he think restaurants, pizzerias and similar establishments have for the city of Maribor and its tourism? Write down his answer.



d) Using GPS, go to the location with the coordinates: 46°33'53.4"N 15°38'55.9"E

Here you will reassign yourself to new groups, marked with numbers, and briefly present the results to the members of the new group.

But where in the “toti” Maribor? (Urban tourist visit planner)

Group E

Field preparation:

On the map of group E (Google my maps), mark five locations in Maribor where it is possible to spend the night. Mark/add the walking route () and measure it () using the appropriate tools on the map of group A (Google my maps). Calculate how much time a tourist would need to see the selected accommodation options if he were to move at a speed of 5 km/h.

A tourist would need _____ minutes.

Fieldwork:

Visit all five points in the fieldwork. Use a stopwatch to measure the duration of your journey from point to point. Take a photo of each point with the Google Lens mobile application and write down some of the main features (at least three) that may be of interest to tourists. You can also obtain information in other ways. Plan the notes together, but each member of the group should write them in their own worksheet.

Plenty of pleasure on the way and a successful rescue.

WHERE TO SLEEP (HOTELS, HOSTELS...)?

a)

Point 1 (name): _____

Description:

Coordinates: _____

Point 2 (name): _____

Description:

Coordinates: _____

Point 3 (name): _____

Description:

Coordinates: _____

Point 4 (name): _____

Description:

Coordinates: _____

Point 5 (name): _____

Description:

Coordinates: _____

b)

How long did it take you to complete the journey? _____

Compare this measurement of time with the calculation of the time it would take a tourist to travel, which you made before the fieldwork using Google my maps. What did you find out?

c) Stop a random passerby and ask him what significance do accommodation facilities have for the city of Maribor and its tourism? Write down his answer.

d) Using GPS, go to the location with the coordinates: 46°33'53.4"N 15°38'55.9"E

Here you will reassign yourself to new groups, marked with numbers, and briefly present the results to the members of the new group.

Synthesis of field work

You have gathered in groups marked with numbers (1,2,3,4,5). Each member of the 'number' group carried out fieldwork in groups which were designated by letters (A,B,C,D,E). Now 'each letter' presents the results of the field work to the other members of the new 'number' group. After the presentations, write down:

- a) What should be taken into account when planning a tourist visit (location, time) in a foreign city (or when planning a tourist visit as employees of a travel agency)?

b) What geographical knowledge can we use when planning a tourist visit?

c) Your group owns a travel agency that organizes tourist visits to Maribor. Plan a two-day tourist visit to Maribor. The tourist will spend the night twice. He wants to visit Maribor on the first day, and he will have the second day off. Make a plan (itinerary: what he will see, how long he will need, where he will have rest and food) for his visit and attach photos of the locations he will visit. We will attach the itinerary to the bulletin board in the classroom.

Activity 8 - Is this story true (spatial development of the city)

Theme	Is this story true? (spatial development of the city)
Topic (Curriculum)	Elementary School: Regional Geography (Europe, World, Slovenia), Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia – settlements, tourism, Home region - geographical features, excursions
	GIM and other secondary schools: Settlements, Tourism, Sustainable Development, Regional Geography (Europe, World, Slovenia), Slovenia - regional and environmental contradictions, excursions.
Target group	ISCED2 (age: 12-14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	30 minutes of preparation, 45 minutes of fieldwork, 15 minutes of synthesis outdoors or in the classroom
Cross-curricular links	History, art history, sociology, ethics and civic education
Organizational forms	Preparation - frontal work, implementation in the field - work in groups; synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Jigsaw puzzle of the photo of medieval Maribor, map of modern Maribor, smartphone ("Google Lens", "Google maps", camera, internet browser), other possible textual sources, pen.
Place of realisation	The task is prepared for the Maribor area. Basic idea can be adapted to other area. In the case of the regional geography of foreign areas, a combination of cabinet study of city stories from abroad and comparison with field work in the home region is possible (the best story).
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. Basic digital skills are required (working with "Google Lens", "Google maps", internet browser). It is important to develop the competence of recognizing authentic textual sources.
Objectives of the activity	<ul style="list-style-type: none"> - Orient themselves and move in the field with a map; - develop the competences of obtaining, analyzing and briefly restoring textual information based on the use of "Google Lens", internet sources and other textual sources; - learn about the history and art history of the area; - learn about the historical and spatial development of the city.
Theoretical basis	The city of Maribor developed along the Drava River, at the junction of

	important transport routes from Carinthia to Ptuj and from Ljubljana to Graz. The first mention of the settlement of Maribor dates in 1204. In 1254, the previous square received city rights. In the period between 1255 and 1275, the city was given walls as a sign of the legal status of the urban settlement and as a means of defense. The walls were improved over time, but in 1782 Maribor lost its former status as a provincial fortress and thus the obligation to maintain the walls. The city expanded and gradually most of the fortifications and defense towers were demolished, and the city moat was filled in. The Water Tower, the Court Tower, the Jewish Tower, the Čeligejev tower, the castle bastion and only modest parts of the walls have been preserved. The image of Maribor with its walls can be seen on the views kept as reproductions by the Maribor regional museum. (<i>Pokrajinski muzej Maribor, digital collection</i>) Getting to know the city walls and the stories related to it is motivation for thinking about the historical and spatial development of the city.
Conclusion (evaluation)	Each group presents the best discovered story related to the city walls. Students compare the veduta with the medieval city walls with a modern map of Maribor. They describe the directions and reasons for the spatial expansion of the city.

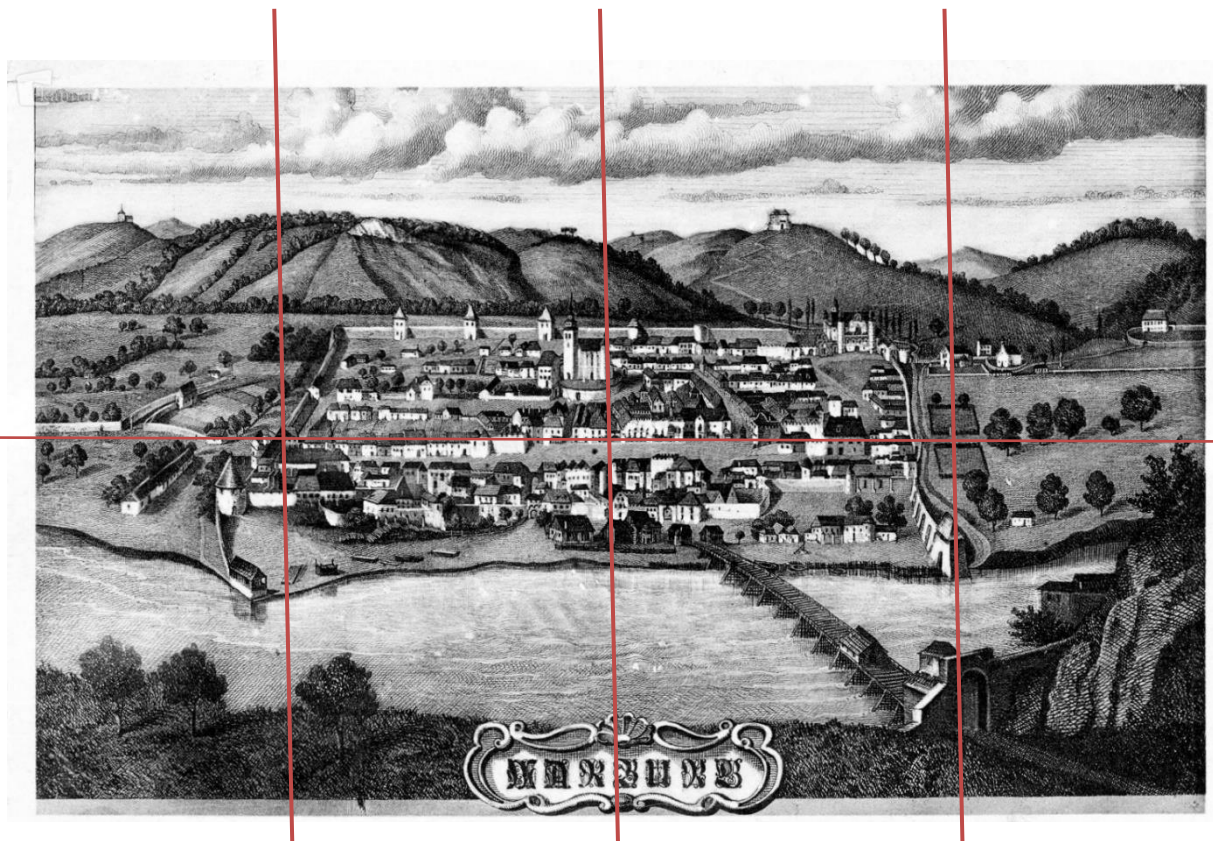
Individual approach suggestions	Talented student	Less-gifted student
	In a heterogeneous group, they complete more elements of the task.	In a heterogeneous group, they complete one element of the task.
	They check the credibility of the sources and justify the findings.	
	They offer help to other students.	

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for field work:</p> <ul style="list-style-type: none"> distributes a cut-out puzzle of a picture of medieval Maribor and gives the instructions, plays the video on Youtube, titled Along the paths of the Maribor wall (https://www.youtube.com/watch?v=55l8Y9OqBao), gives instructions for comparing a modern map of Maribor with a picture of medieval Maribor (observing the differences in the 	<ul style="list-style-type: none"> they put together a picture, describe it and try to recognize the place, watch and comment the video, they compare a picture of medieval Maribor with a map of modern Maribor, they form conclusions about the spatial development of the city over time (differences in architecture, street widths, purposes of buildings), get to know the purpose, goals and

	spatial structure of the city), <ul style="list-style-type: none"> explains the purpose, goals and methods of field work , guides division into groups and leads a conversation about the security plan. 	methods of field work, <ul style="list-style-type: none"> divide into groups and get to know the security plan.
task 2	Leads the groups to starting point 1, distributes maps of modern Maribor. Monitors the work of the groups and advises if necessary.	They do fieldwork (each group visits at least two towers of the former city walls and one city square - they choose between Castle Square, Jewish Square, Main Square and Slomškovi Square). They mark the visited locations on the map. At each location, with the help of the Google Lens application or in some other way (visiting a tourist information center, interviewing passers-by...) they collect interesting historical information related to that point.
task 3	Monitors the work of groups and advises if necessary.	The groups choose the most interesting information and transform/form it into a story with the help of their own imagination.
task 4	Accepts groups on endpoint 4. Outdoors or in the classroom: Directs the work of the groups and leads a conversation about the credibility of the sources used.	Each group presents its own story; listeners guess what is true and what is imaginary in the story. They get to know some criteria for identifying the credibility of sources.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.
Notes: /		

Key to the worksheet: /

Jigsaw puzzle of the photo of medieval Maribor (source of the picture: Pokrajinski arhiv Maribor, digital collection)



Modern map of Maribor with city towers



Activity 9 - Urban plants - a research walk

Theme	Urban plants - a research walk
Topic (Curriculum)	<p>Elementary School: Life on the continent, Climatic characteristics of the Earth, Regional geography (Europe, the World, Slovenia), Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia - settlements; Home region - geographical features, excursions</p> <p>GIM and other secondary schools: Flora and fauna, Weather and climate, Settlements, Sustainable development, regional geography (Europe, World, Slovenia); Slovenia – regional and environmental contradictions; excursions, etc.</p>
Target group	ISCED2 (age: 11-14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	5 minutes of preparation, 40 minutes of fieldwork, 30 minutes of synthesis in the form of homework, 10 minutes of final discussion in class
Cross-curricular links	Biology, informatics
Organizational forms	Preparation and implementation in the field - frontal and individual work in the form of a joint research walk, synthesis - individual homework, a short joint interview in class after homework
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet, smartphone (mobile applications "PlanNet" or "Google Lens"), digital air thermometer, pen.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other urban area and meaningfully connect it with the regional geography of other regions (Europe, the World, Slovenia).
Environment's specifics	

Required entry knowledge and skills of students	Basic digital skills are required (working with mobile applications "PlantNet" or "Google Lens").
Objectives of the activity	<ul style="list-style-type: none"> - With the help of digital tools, they identify plant species in urban areas and measure air temperatures at standing points; - they recognize the impact of urban plants on the quality of life in the city (temperature moderation, aesthetics, relaxation areas...); - name the most common urban plants, indicate their original location and compare the growth conditions in the original location and in the researched area; - evaluate the quantity relation between native and non-native urban

	plants.
Theoretical basis	Clean and fresh air, water, food... Key things for survival that we can get from plants. In addition, plants moderate the heat, provide shelter for animals and beautify the space. In the medieval city center, there was not much space for plants, but today, due to the listed benefits, we try to green as much of the city as possible. Urban plants are plants that thrive in densely built-up urban areas and are therefore extremely important for the quality of living in cities, especially from the point of view of mitigating climate change or urban heat islands. From the point of view of preserving biodiversity, it is very good if we give priority to native species in the greening of cities, but sometimes the changed climatic conditions do not allow this.
Conclusion (evaluation)	The synthesis takes place individually with the help of the last set of questions on the worksheet in the form of homework. In the classroom, there is a review of the worksheet and an argumentative problem interview in a frontal format.

Individual approach suggestions	Talented student	Less-gifted student
	They perform more detailed analysis and prepare more in-depth justifications.	They perform simpler analysis and justifications.
	They organize and/or prepare a synthesis presentation of the results of the field assignment for the whole class (a poster for an exhibition, an article for the school or local newspaper or radio, news on selected websites)....	They do a reduced amount of work.

Activity scenario	Teacher activities	Students' activities
task 1	Preparation for fieldwork: <ul style="list-style-type: none"> • leads the class to point 1, gives work instructions, distributes worksheets, • lead a conversation about the safety plan. 	<ul style="list-style-type: none"> • get to know the goals and methods of work, • review the worksheet and necessary applications, • get to know and co-create the rules of safe research on the streets.

task 2	He leads the students on a group research walk with short stops at standing points.	They carry out field work (they photograph and identify plant species and measure the air temperature at the stand points).
task 3	Gives instructions for homework.	They review the homework instructions (synthesis of fieldwork).
task 4	In the classroom reviews the completed homework and leads a discussion.	They report on the results of their home work (they name the most common urban plants, indicate their original location and compare the growth conditions at the original location and in the researched area, evaluate the ratio between native and non-native urban plants).
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.
Notes: /		

Key to the worksheet: /

Urban plants - a research walk

Instructions for working on a research walk:

1 Download the PlantNet or Google Lens mobile app.

2 Take photos of the different plants you see at the stand points. You can also take photos of plants on the way between points.

3 At each point, write down the names of the observed plants. Measure the air temperature together at each point. Write it down in the Table 1.

Table 1: Plants and air temperatures at standing points

Standing point	Names of observed plants	Temperature of the air
1		

2		
3		
4		

A final thought - homework

1 Compare the measured temperature at all standing points. At which point was the temperature the highest and at which was the lowest? What factors can affect the temperatures in the city?

2 How can plants affect the quality of life in the city?

3 Which three plants most often appear on the walking path in Maribor?

4 Find out where the three most commonly seen plants come from.

Table 2: Origin location of the most common plants

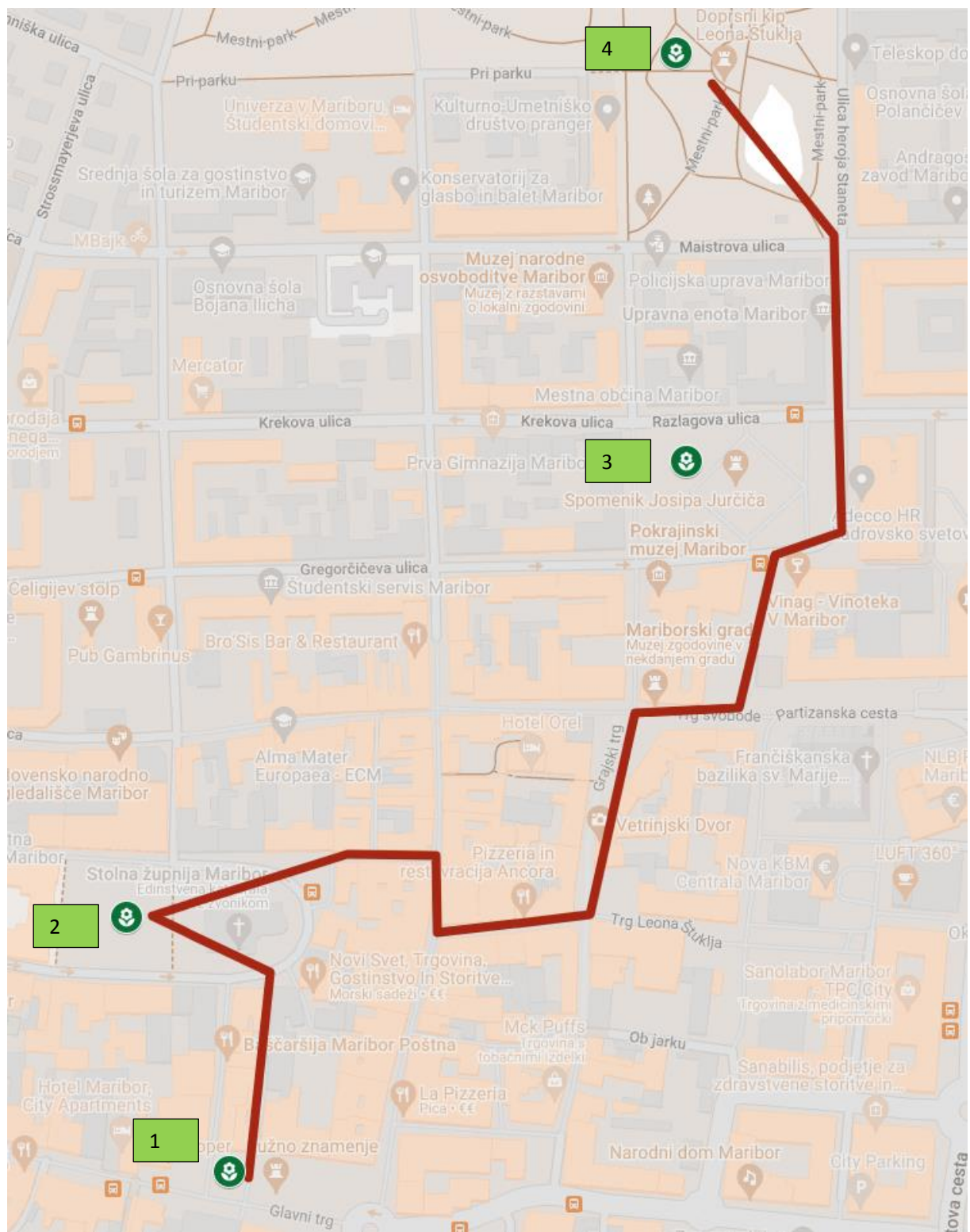
Name of the plant	Origin location (state, region...)


--	--

5 Investigate whether the plants in the original location have similar living conditions as in Maribor (climate, soil)? Write a brief justification for your answer.

6 Are native (originating from Slovenia/Europe) or non-native plant species (originating from other areas of the world) dominant on the observed route? Do you think this situation is good? Why do you think so?

Map of Maribor with points for researching urban plants



Legend:  - a stopping point for exploring urban plants

Activity 10 - Sustainable development live - project work

Theme	Sustainable development live - project work
Topic (Curriculum)	Elementary School: /
	GIM and other secondary schools: Sustainable Development, Slovenia – regional and environmental contradictions.
Target group	ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	90 minutes of project preparation, 90 minutes of field work outside the school schedule, 45 minutes of synthesis in the form of homework, 45 minutes of presentation and evaluation at school
Cross-curricular links	English, sociology, informatics
Organizational forms	Preparation of project work - frontal and group work, implementation in the field - group work, synthesis - group and individual homework, presentation and evaluation at school - frontal and group work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Written work instructions, pen, computer, smartphone (Skype, Google Forms, Google Drive, Power point).
Place of realisation	The task can be performed in the center of a city or settlement. It is designed for Maribor, but it can be adjust to any other city or settlement.
Environment's specifics	

Required entry knowledge and skills of students	Basic digital competences are required (working with Skype, Google Forms, Google Drive, Power point).
Objectives of the activity	<ul style="list-style-type: none"> - Explain the concept of sustainable development and its indicators; - recognize and evaluate various activities from the point of view of sustainable development; - develop an interest in social needs, solving common sustainable problems at the local, regional and national level; - develop concern for balanced use of space and for preserving the quality of the environment for future generations; - are trained in the project dynamics of (teaching) work; - are trained in recording and displaying data in various formats; - are trained in communication, develop the ability to verbally,

	quantitatively and graphically express geographical data.
Theoretical basis	"In order to achieve the goals of sustainable development, it is important that we all believe that we are capable and responsible of implementing positive changes and making decisions that can contribute to social equality, environmental protection and economic prosperity in the long term development. That's why we need knowledge about the connections between human activity and the environment, as well as skills to participate in the processes of planning and use of space." (Simoneti et al. 2022) The project work in the present activity helps young people to raise awareness of the connections between human activity and the state of space and strengthens their ability to cooperate with others in the processes of using and organizing space. The content basis of the project activity is Egan's Wheel in English, which strengthens cross-curricular connections with English or language competence. This bike highlights sustainability criteria and evidence of lack of sustainability.
Conclusion (evaluation)	The synthesis of the project work consists of two parts. The first part takes place in the form of group and individual homework (analysis of obtained data and preparation of a presentation). The second part takes place in the classroom - presentation of the results of the work with discussion and evaluation of the project work.

Individual approach suggestions	Talented student	Less-gifted student
	They do more work, they do managerial work, more precise analysis, more in-depth reasoning.	They do a reduced amount of work.
	They organize and/or prepare the dissemination of work results.	They perform simpler analysis and justifications.
	They organize and/or prepare the dissemination of work results.	

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for project work:</p> <ul style="list-style-type: none"> prepares materials for the implementation of project work, prepares the ICT base (Google Drive folders), prepare an introductory presentation on sustainable development and an overview of 	<ul style="list-style-type: none"> get to know or refresh the basics of the concept of sustainable development and get to know the Egan bike, get to know the goals and methods of project work and complement and develop them,

	<p>the indicators in Egan's wheel,</p> <ul style="list-style-type: none"> • presents goals and instructions for project work, which the students then supplement and develop inclusively, • leads the division of students into 3 groups and conducts an interview about safety during research. 	<ul style="list-style-type: none"> • divide into groups, learn about and co-create the rules of safe research on the streets.
task 2	Gives instructions for further independent tasks. He is available for help and guidance.	They examine their field of sustainable development with the help of the Egan Wheel, with the help of literature and the Internet, they find information and data about the assigned field, they save the data in a Google Drive folder in the form of notes or Power Point presentations. They make a content and time plan for further work.
task 3	Monitors the work, progress of the group, is available for help and direction.	The group consults and formulates at least 5 questions for interviews with competent organizations. They arrange an interview via the chosen tool (e.g. Skype). They save the main findings or excerpts from the interviews in a Google Drive folder in the form of notes or Power Point presentations.
task 4	Monitors the work, progress of the group, is available for help and direction.	<p>They compose 3-5 questions for random respondents on the streets. The questions are designed and entered into the Google Forms tool (in the Google Drive folder).</p> <p>They conduct surveying in the city center.</p>
task 5	Monitors the work, progress of the group, is available for help and direction.	They carry out an analysis of answers from interviews and surveys by source groups (according to the field of sustainable development). They prepare a final presentation with key findings from the literature, interviews and surveys. They add a suggestion of one activity or improvement that would contribute to the development of the field of sustainable development that the group addressed.
task 6	Moderates the group presentations and leads the debate. Leads the evaluation of project work.	They present the results of group work and evaluate the entire process of project work. They make a plan for possible dissemination of work results.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.

<p>Notes: It is important that students understand and become aware of the importance of the project work process and their active role and responsibility in carrying out all its steps - from planning, implementation to evaluation. They should also understand their project work as preparation for market project work in their future profession.</p>	

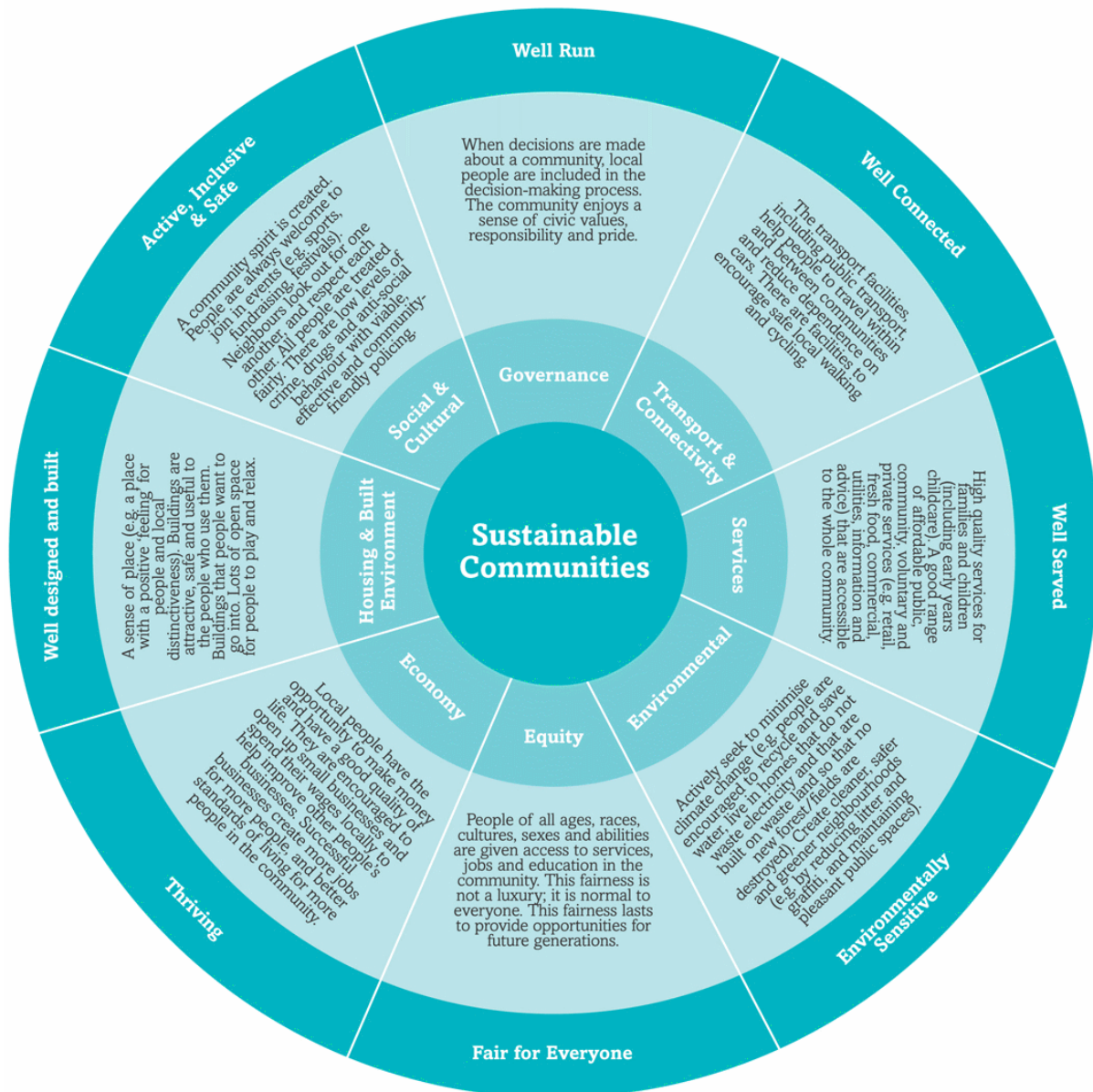
Key to the worksheet: Idea adapted from Simonič 2021

Sustainable development live - project work

Instructions for work

- Divide into 3 groups:
 - 1st group – the economic field of sustainable development,
 - 2nd group – social field of sustainable development,
 - 3rd group – environmental field of sustainable development.
- In Appendix 1, you can find Egan's wheel, which represents the basic criteria for determining the sustainability of the selected community. The group instructions contain a precise definition of the criteria that each group includes in its work.
- In Appendix 2, you can find an example of the typology of survey questions, which should be used in the preparation of the survey and interview. The content of the questions in Annex 2 is random and not related to the topic of sustainable development.
- Within the group, agree on the division of work and the tasks of each individual and on the time course of the work.
- During the entire group work, a Power Point presentation is created, which will be the basis for the final presentation of the main findings.
- Share all documents with the group in the corresponding Google Drive folder, where everyone can access all the information obtained and the final products.

APPENDIX 1 – EGAN'S WHEEL OF SUSTAINABLE DEVELOPMENT CRITERIA



Source: https://www.geography.org.uk/download/ga_prbsceganwheel.gif

APPENDIX 2 - TYPOLOGY OF SURVEY QUESTIONS

1. *BASIC QUESTIONS*

- a) Do you think there are enough trash cans in the city park?
- YES
 - NO
 - I DON'T KNOW

2. *SPECIFIC QUESTIONS* (possibility of choosing one or more answers)

- b) What is your favorite way to relax?
- I'M GOING TO THE PARK
 - I GO SHOPPING
 - I DO SPORTS
 - I AM IN MY ROOM
 - OTHER: _____

3. *RANKED QUESTIONS*

- c) Rank the features of the rest area in order of importance (1 – most important, 5 – least important):
- ☐ SILENCE
 - ☐ LIGHT
 - ☐ COMFORT
 - ☐ APPROPRIATE TEMPERATURE
 - ☐ AESTHETIC ARRANGEMENT

4. *OPEN QUESTIONS*

- d) What is most important to you in the arrangement of the city center?
ANSWER: _____

Instructions 1st group – Economic field of sustainable development

1. Read and study the contents of Egan's wheel in the appendix. Focus on evidence of sustainability or to evidence of lack of sustainability in your assigned field.
Your group will focus on the following areas:
 - a) ECONOMY - ECONOMY
 - b) SERVICES - SERVICES
2. Using the clues from Egan's Wheel, find data and information for your fields using the Internet and literature. Focus only on the Maribor area.
 - a) Example: cue JUSTICE - you are looking for data on the equality of ethnic groups and genders regarding the possibility of education, employment, etc.
 - b) Edit and save data on the fly in notes or directly in the Power Point tool. Save the files in marked Google Drive folders.
3. Based on the literature read and the information found, formulate at least 5 questions for the interview. You will conduct the interview in a group via the Skype tool or by agreement with the interviewee.
 - a) Interview an organization or person working in your field of sustainable development. Below is a list of potential interlocutors, you can also add your own suggestions.
 - Maribor Regional Chamber of Crafts - <https://ooz-maribor.si/>
 - Municipality of Maribor - <https://www.maribor.si/>
 - b) Insert or write down the main findings or excerpts of the interview in your notes or Power Point presentation (Google Drive folder).
4. Prepare to survey in the city center.
 - a) In a group, prepare 3-5 questions for random passers-by on the streets of Maribor. The questions should be short, concise and related to your findings so far (based on literature and interviews).
 - b) Next is the analysis of the answers within the groups (your field of sustainable development). Add graphs and tables to a Power Point presentation (Google Drive folder).
5. For the final Power Point presentation, add one activity or improvement that would contribute to the development of your field of sustainable development in Maribor.
6. From all the notes and findings in the Google Drive folder, prepare a final presentation lasting 10-15 minutes. We will spend about 5 minutes debating your conclusions.

Instructions for the 2nd group - Social field of sustainable development

1. Read and study the contents of Egan's wheel in the appendix. Focus on evidence of sustainability and evidence of lack of sustainability in your assigned field.
Your group will focus on the following areas:
 - a) SOCIAL AND CULTURE – SOCIAL & CULTURAL
 - b) MANAGEMENT - GOVERNANCE
 - c) JUSTICE - EQUITY
2. Using the clues from Egan's Wheel, find data and information for your fields using the Internet and literature. Focus only on the Maribor area.
 - a) Example: cue JUSTICE - you are looking for data on the equality of ethnic groups and genders regarding the possibility of education, employment, etc.
 - b) Edit and save data on the fly in notes or directly in the Power Point tool. Save the files in marked Google Drive folders.
3. Based on the literature read and the information found, formulate at least 5 questions for the interview. You will conduct the interview in a group via the Skype tool or by agreement with the interviewee.
 - a) Interview an organization or person working in your field of sustainable development. Below is a list of potential interlocutors, you can also add your own suggestions.
 - Center for Social Work Maribor - <https://www.scsd.si/centri-za-socialno-delovanje/seznam-csd/csd-maribor/>
 - Youth Cultural Center Maribor - <https://mkc.si/>
 - b) Insert or write down the main findings or excerpts of the interview in your notes or Power Point presentation (Google Drive folder).
4. Prepare to survey in the city center.
 - a) In a group, prepare 3-5 questions for passers-by. The questions should be short, concise and related to your findings so far (based on literature and interviews).
 - b) Next is the analysis of the answers within the groups (your field of sustainable development). Add graphs and tables to a Power Point presentation (Google Drive folder).
5. For the final Power Point presentation, add one activity or improvement that would contribute to the development of your field of sustainable development in Maribor.
6. From all the notes and findings in the Google Drive folder, prepare a final presentation lasting 10-15 minutes. We will spend about 5 minutes debating your conclusions.

Instructions 3rd group - Environmental field of sustainable development

1. Read and study the contents of Egan's wheel in the appendix. Focus on evidence of sustainability and evidence of lack of sustainability in your assigned field.
Your group will focus on the following areas:
 - a) ENVIRONMENTAL
 - b) HOUSING & BUILT ENVIRONMENT
 - c) TRANSPORT AND CONNECTIVITY – TRANSPORT & CONNECTIVITY
2. Using the clues from Egan's Wheel, find data and information for your fields using the Internet and literature. Focus only on the Maribor area.
 - a) Example: cue JUSTICE - you are looking for data on the equality of ethnic groups and genders regarding the possibility of education, employment, etc.
 - b) Edit and save data on the fly in notes or directly in the Power Point tool. Save the files in marked Google Drive folders.
3. Based on the literature read and the information found, formulate at least 5 questions for the interview. You will conduct the interview in a group via the Skype tool or by agreement with the interviewee.
 - a) Interview an organization or person working in your field of sustainable development. Below is a list of potential interlocutors, you can also add your own suggestions.
 - Ecologists without borders - <https://ebm.si/glavna/web/>
 - Marprom - <https://www.marprom.si/>
 - b) Insert or write down the main findings or excerpts of the interview in your notes or Power Point presentation (Google Drive folder).
4. Prepare to survey in the city center.
 - a) In a group, prepare 3-5 questions for passers-by. The questions should be short, concise and related to your findings so far (based on literature and interviews).
 - b) Next is the analysis of the answers within the groups (your field of sustainable development). Add graphs and tables to a Power Point presentation (Google Drive folder).
5. For the final Power Point presentation, add one activity or improvement that would contribute to the development of your field of sustainable development in Maribor.
6. From all the notes and findings in the Google Drive folder, prepare a final presentation lasting 10-15 minutes. We will spend about 5 minutes debating your conclusions.

Activity 11 - What's going on downtown (mapping the age and functions of buildings)

Theme	What's going on downtown? (mapping the age and functions of buildings)
Topic (Curriculum)	Elementary School: Regional geography (Europe, the World, Slovenia), Geographical space of Slovenia as a limiting and stimulating factor in the development of Slovenia - settlements; Home region - geographical features, excursions
	GIM and other secondary schools: Settlements, Sustainable development, regional geography (Europe, World, Slovenia); Slovenia – regional and environmental contradictions; excursions, etc.
Target group	ISCED2 (age: 11-14), ISCED3 (age: 15-18)
Duration (outdoor, indoor part)	30 minutes of preparation, 45 minutes of field work, 15 minutes of in-class synthesis
Cross-curricular links	History, art history
Organizational forms	Preparation - frontal work, field work - work in pairs, synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Map of the city center or settlements, written work instructions, crayons.
Place of realisation	The task is prepared for the Maribor area. It is possible to adapt it to any other settlement and meaningfully connect it with the regional geography of other regions (Europe, the World, Slovenia) - here we combine the cabinet work with Google Earth/Google Street View (foreign city) with the results of field work (home settlement) and compare age and/or functions of buildings in the center of both cities/settlements.
Environment's specifics	

Required entry knowledge and skills of students	/
Objectives of the activity	<ul style="list-style-type: none"> - Implement the mapping method in an analog way: observe and collect data about space and transfer it to the map (develop spatial literacy); - practice orientation, use and understanding of the scale, content and equipment of the map; - determine/estimate the age and purpose of buildings (functions) in the selected part of the city/settlement; - to explain the connection between the intended purpose and the maintenance and age of the mapped buildings.;

	- propose solutions for better spatial utilization of the city center/settlement.
Theoretical basis	Mapping is the collection of data about space and the display of this data on maps. At the same time, it is a method that strengthens the competence of observation, through which we get to know selected characteristics of the environment that interest us. We can map various contents. Mapping the age and purpose (functions) of buildings is particularly interesting in the city center due to the concentration of only these, while determining what is happening in this part of the city/settlement, as well as for researching the topic of emptying city centers, which can lead to unsustainable use of premises and space as a whole.
Conclusion (evaluation)	The synthesis takes place as frontal work after checking the assigned tasks of the pairs, namely in the form of a discussion with the students about their findings and proposals for the spatial development of the city center.

Individual approach suggestions	Talented student	Less-gifted student
	They perform more detailed analysis and prepare more in-depth justifications.	They perform simpler analysis and justifications.
	They organize and/or prepare a synthesis presentation of the results of the field assignment for the whole class (a poster for an exhibition, an article for the school or local newspaper or radio, news on selected websites)....	They do a reduced amount of work.

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <p>Preparation for field work:</p> <ul style="list-style-type: none"> • distribute work instructions, present the purpose, goals and work process and explain any ambiguities, • leads the division of students into pairs and the distribution of pairs by mapping areas (each pair maps the buildings on both sides 	<ul style="list-style-type: none"> • get to know the purpose, goals and work process, • divide into pairs, take over their mapping area, • each pair manually enlarges the map of the selected part of the street to scale and furnishes it, • get to know and co-create the rules of safe

	of the street in a length of cca. 100 m), <ul style="list-style-type: none">• manually enlarge and redraw the selected part of the street to scale, equip the map accordingly,• leads a conversation about the safety plan.	research on the streets.
task 2	Leads the students to the starting point, checks the work of the pairs and gives advice if necessary.	They carry out field work (with the help of legends, their own recognition and possible conversation with passers-by or other sources, they map the purpose and age of the buildings in the selected area according to the instructions).
task 3	Gives instructions for homework. Adds the products of pairs.	Pairs make a clear card and a description of it. The product is delivered to the teacher at the agreed place.
task 4	In the classroom gives an evaluation of the completed homework and leads a discussion with the students about the methodology of the work and findings in the field.	They report on the results of the field work. They focus on proposals to improve the appearance and functionality of the city center.
Implementation risks		A preparatory conversation about safe research on the streets (safety plan) is needed.
Notes: /		

Key to the worksheet: /

What's going on downtown? (mapping the age and functions of buildings)

Instructions for work :

- a) On the general map of the city of Maribor, circle the buildings that you will map in red.
- b) From the map of the city, **redraw the area to be mapped - scaled up to an A4 sheet**. Prepare a special box next to the floor plan of each building, where you will write the house number in the field.

Prepare a copy of this chart, which you will need to make a clear chart.

- c) Using the attached legend, **determine the FUNCTION and AGE of individual buildings** on the both sides of the chosen street. You can add to the legend if necessary.

You map by coloring or you cross-hatched the floor plan of each building on your map according to the corresponding legend.

When making a map of building functions, estimate (only on the outside) the scope of each activity, if there are several of them in one building. In this case, divide the floor plan of the building into several parts in accordance with the estimated scope of activities. Paint the floor plans of the buildings according to the assessment.

Map the current state of the building functions in the selected part of the settlement (mark spaces that are vacant today, although inscriptions from the past may still be visible).

Mark any changes on the maps: cross out buildings that are no longer there, add new ones...

d) **Take a photo of the mapped part of the city. If possible, also look for an older (approx. 30-50 years) photo of the mapped part of the city.**

e) After completing the field work, **make a clear map**. Equip the map with the title, street names, mapping date, legend, scale, sky directions.

f) **Describe the created map - help yourself with the following questions:**

What is the average age of buildings in this part of city center? How are these buildings maintained? In terms of purpose (i.e. function), which buildings are there the most frequent in the mapped part of the city? Why are these activities located in this particular part of the city? Which activities were located in this part of the city before approx. 30-50 years? Why did the change occur (if any)? What is the proportion of buildings with empty, abandoned spaces, i.e. functionally degraded buildings? Suggest a solution or solutions to improve the appearance and functionality of objects in the mapped area?

THE FINAL ASSIGNMENT SHOULD CONTAIN: a hand-made map with the marked age and functions of the objects; photograph(s) of the mapped street; a description of the map according to the questions (see f) and a list of possibly used literature and sources.

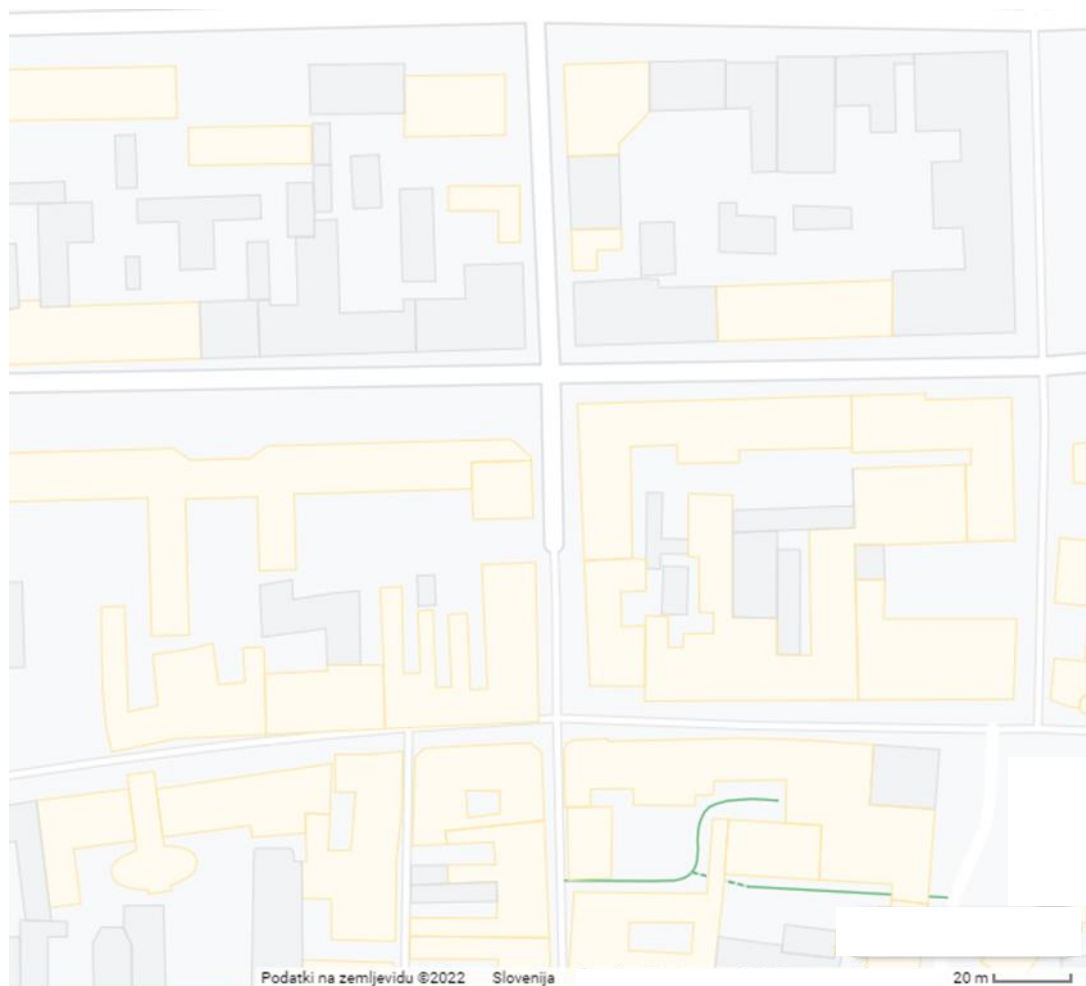
Annex 1: Legend proposal

Functions of buildings

Shops (with food, clothes, shoes, other items...)	
Services (service activities: hairdresser, beautician, watchmaker...)	
Hospitality and tourist activities (patisserie, guesthouse, hotel...)	
Public institutions, administration (post office, school, health center...)	
Apartments	
Other (business premises - production and non-production, offices, warehouses...)	
Empty premises (G – in good condition, B – in bad condition, R- under renovation)	

Age of buildings

Medieval building	+++++
A building built between the 16th century and 1900	-----
A building built between 1900 in 1960
A building built between 1960 in 2010	*****
A building built between 2010 in 2022	////////

Annex 2: Example of a basic, partly equipped map of part of Maribor

Activity 12 - We protect waters

Theme	We protect the waters
Topic (Curriculum)	Elementary School: Life on the continent, Life by the coasts and on the islands, Climatic characteristics of the Earth, Regional geography (Europe, the World, Slovenia), Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia - settlements; Home region - geographical features, excursions GIM and other secondary schools: /
Target group	ISCED2 (age: 14)
Duration (outdoor, indoor part)	10 minutes of preparation, 45 minutes of fieldwork, 15 minutes of final discussion outdoors or in the classroom
Cross-curricular links	Biology, chemistry, physics, mathematics
Organizational forms	Preparation - frontal work, execution - group work, synthesis - frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Worksheet, 5 water collection beakers, filter paper, drinking water in a bottle, white base/beaker base paper, empty bottle with cap, universal indicator paper, stopwatch, air thermometer, water thermometer, pen.
Place of realisation	It is necessary to choose a watercourse with possible and safe access to river water to capture only this.
Environment's specifics	

Required entry knowledge and skills of students	/
Objectives of the activity	<ul style="list-style-type: none"> - Perform simple field measurements of the physical and chemical characteristics of running water (floating material, color, smell, water pH, river flow speed, water and air temperatures); - compare, connect and explain measurement results; - draw conclusions about the polluters of a specific watercourse; - describe the possibilities of protecting running water; - suggest the possibilities of water pollution research procedures.
Theoretical basis	Waters are highly exposed to pollution, as humans have reduced their natural self-cleaning abilities through various interventions (dams, regulations, etc.). "Compared to stagnant waters, rivers are less sensitive, as

	<p>their water changes quickly, but the amount of waste water is the highest in them. Only a few decades ago, the rivers themselves managed to break down and neutralize the pollution, but then excessive loads with waste water exceeded their self-purification abilities..." (Senegačnik, 2002). Due to the stated and exceptional importance of water for humanity, it is necessary to pay special educational and research attention to water. Several laboratory and other tools are available for didactic water research, but they are not always available in schools, so the exercise shows a very simple approach to basic water pollution research, which can mostly be helped with household tools.</p>
Conclusion (evaluation)	<p>Outdoors or in the classroom, there is a review of the worksheet, which includes ongoing and final synthesis questions. Group work is monothematic – at the end groups compare their findings. The search for reasons for similarities or differences in the results of the groups has additional substantive and methodological value.</p>

Individual approach suggestions	Talented student	Less-gifted student
	They perform a more precise analysis or analyze samples at several measuring points.	They do a reduced amount of work.
	They combine simple analyzes with laboratory ones with the help of a didactic case for water analysis.	They participate in parts of the proceedings where possible.
	They prepare more in-depth justifications, use additional available sources and literature. They suggest other simple methodological approaches to water research.	They prepare less in-depth justifications.

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <ul style="list-style-type: none"> • gives work instructions, distributes worksheets, • lead a conversation about the safety plan and lead the class to the selected location, where they arrange the devices at different measuring points along the watercourse, • assign groups of students to several measuring points by the watercourse and give instructions for group circulation. 	<ul style="list-style-type: none"> • get to know the goals and methods of work, • review the worksheet, • get to know and co-create the rules of safe research, • each group is assigned to its measuring point by the watercourse.

task 2	If necessary, advises and directs the work of groups.	In groups, they perform fundamental analyzes of water according to the worksheet (the group performs an individual exercise at a designated standing point; the groups move from point to point).
task 3	In the open air or in the classroom, he conducts a review of the completed work and a discussion.	They report on the results of the work with an emphasis on synthesis questions. They compare and justify the similarities and differences in the results of the groups.
Implementation risks		Appropriate footwear for students is required and special care must be taken when choosing measurement points along the water course for the safety of students.
Notes: /		

Key to the worksheet: /

We protect the waters

1 Investigating the presence of floating particles in river water

The floating particles indicate the origin of the water and the path it has taken. These can be particles that rise from the ground, or particles that enter the water and its surroundings naturally or as a result of human activity.

Tools for work: 2 glasses, filter paper

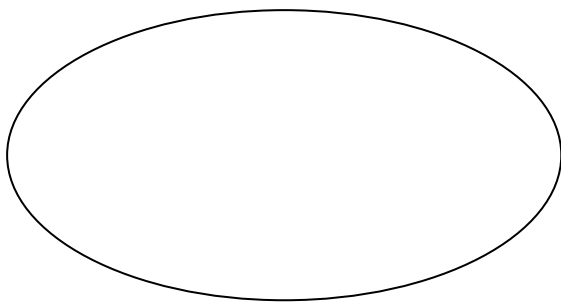
Work process:

- a) Approach the river in an accessible place. Take the first glass and fill it with water from the river.
- b) You will filter the water from the river through filter paper. Place another beaker below, into which the filtered water flows.
- d) After filtering the water, observe the material left on the filter paper.

Questions after exercise 1:

Draw the residue on the filter.

Describe the residue on the filter.



2 Exploring the color of river water

Pure natural water is usually colorless. Water in nature is often colored due to the presence of various compounds. In addition, the color of the bottom of the bed along which the water flows affects the color of the water or the surroundings of the watercourse too. Water can also be colored by pollution.

Tools for work: 2 glasses, white base (paper), drinking water in a bottle

Work process:

- a) Collect water from the river in a glass.
- b) Place the glass with water on a white base. Next to it, place another glass into which you pour drinking water from the bottle. Observe the color of the water in both glasses and compare them.

Questions after the exercise:

What color is river water (compared to drinking water)?

What affects the color of analyzed river water?

3 Exploring the smell of river water

The smell does not appear in clean water. The smell of water is affected by various substances that are dissolved in it and are often the result of activities in the vicinity. Depending on the type of smell, we distinguish the smell of rotting, fertilization, rotting, faeces.

Tools for work: bottle with cap, clock

Work process:

a) Fill the bottle with water from the river.

b) Close the bottle and shake it slightly for about half a minute. Open the bottle and smell the water sample. With the help of Ball's scale, determine the degree of smell.

Ball ratings:

0 - No Odor

1 – very bad smell

2 – bad smell

3 – perceptible smell

4 – distinct and distinct smell

5 – strong smell

Questions after the exercise:

The smell level of river water is: _____

If river water has a smell, what kind is it?

4 Compare the findings of all three exercises and answer the following questions:

You have identified three characteristics of river water. Compare river water with drinking water. Do they differ in all three characteristics? How? What can you conclude about the quality of the selected river water?

Look around the measuring site. What human activities near the river can affect the water quality in it? What (how) do these activities affect river water quality?

5 Researching the pH reaction of river water

The reaction of water, i.e. acidity or basicity, plays an important role in the research and study of water. It affects changes in biological processes and the development of life in water. But it can also be an indicator of pollution.

Tools for work: universal indicator paper

Work process: Wet the indicator paper in water and immediately compare its color with the color measuring scale.

The reaction of water is expressed by the pH value:

under 4	extremely acidic	5.0 – 5.9	acidic	7.0	neutral	8.0 – 8.9	basic
4.0 – 4.9	strongly acidic	6.0 – 6.9	weakly acidic	7.1 – 7.9	weakly basic	above 9.0	strongly basic

Question after the exercise:

Compare the result with the observations from the previous exercises. What do you find out?

6 Measuring the speed of the river current

Tools for work: a stopwatch, a piece of natural material (feather, twig, piece of cork...)

Work procedure:

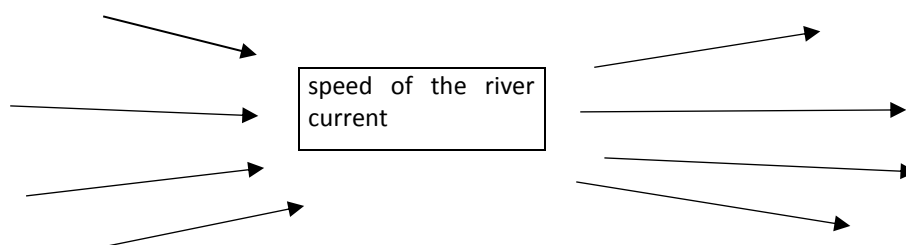
Measure the distance between two points along the river bank (approx. 5 – 10 m). At the first point, throw a natural light piece of material (feather, leaf...) into the water. First, throw a piece of material closer to the left, then closer to the right bank, and then into the middle of the river stream. Measure the time it takes for the piece to move between the two points along all three paths. Repeat the individual measurement twice. Calculate the speed of the river current at individual measurements and the average speed. Enter the results in the table below.

The distance between points (d) is: meters

Measurement location	t_{1,2,3} (s) – average of two measurements	v_{1,2,3}=d/t_{1,2,3} (m/s) – average of two measurements	average speed of the river current $v = (v_1 + v_2 + v_3) / 3$
Along the left bank			
Along the right bank			
In the middle of the stream			

Question after the exercise:

Complete the simple mindset below the text by writing on the left side the factors on which the speed of the river flow depends; on the right side, the factors that are influenced by the speed of the river flow (arrows can be added).



7 Measuring the temperature of river water

Tool for work: water thermometer

Work procedure:

Dip the thermometer in water and hold it slightly to one side. Read the temperature after at least a good minute. The thermometer must be in the water at the time of reading.

The temperature of the river water is	
---------------------------------------	--

8 Air temperature measurement

Tool for work: an air thermometer

Work procedure:

Hold the instrument in the shade about 1.5 meters above the ground or install it in a suitable place where you leave it for approx. 5 minutes. Read the temperature.

The air temperature is	
------------------------	--

Questions after speed and temperature measurements

Compare the temperature of the water and the temperature of the air. Explain the causes of the difference in temperature of water and air.

Describe the relationship between river current speed and water temperature.

How can river flow speed and water temperature be related to river water pollution?

Final questions

How can an individual contribute to water protection? How can the local and wider community contribute to water protection?

Your suggestion for the water pollution investigation process:

Activity 13 - Urban river banks-conflicts and activities

Theme	Urban riverbanks - activities and conflicts
Topic (Curriculum)	Primary school: Geographical space of Slovenia as a limiting and encouraging factor in the development of Slovenia, Economy
	GIM and other secondary schools: Regional and environmental contradictions in Slovenia, Settlements, Waters
Target group	ISCED2 (age: 14), ISCED3 (age: 18)
Duration (outdoor, indoor part)	45 minutes of preparation in class, 90 minutes of field work, 45 minutes of analysis and synthesis in class
Cross-curricular links	Sociology, Biology
Organizational forms	Preparation - frontal work, implementation in the field - work in groups, synthesis-frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Table 1, Map 1, pen, digital camera
Place of realisation	The bank of the Drava River in Maribor (can be the bank of the river in a given settlement)
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. It is necessary to print the card and table for registration.
Objectives of the activity	<ul style="list-style-type: none"> - Students recognize conflicting activities in the space, - think about their own environmental values, which led them to the conclusions, - prepare a proposal for solutions to existing conflicts.
Theoretical basis	Due to their many functions, cities often represent areas in which conflicting activities take place, which creates conflicts and thus reduces the value of space. It is important to recognize conflicting activities in time. Due to the attractive living areas, views, favorable microclimate and traffic, tourism and other activities, riverbanks in cities are often areas in which activities are created that contradict each other. It is important to prevent potential conflicts already when planning interventions in the space.
Conclusion (evaluation)	Students compare findings and solutions with each other and discuss them.

Individual approach suggestions	Talented student	Less-gifted student
	They carry out field work in larger settlements with river banks.	They only do mapping activity.
	They compare conclusions and solutions between individual cities	

Activity scenario	Teacher activities	Students' activities
task 1	Preparation for field work: explanation of theoretical foundations, review of the worksheet, dividing students into pairs or groups.	Students become familiar with the basic issue: activities in the city that cause conflicts.
task 2	Leads the students to a common starting point (agreement on meeting point). Monitors the work of the groups and advises if necessary.	Students walk through the area of interest and identify conflicting activities, which they write in a table and take photos. They also enter proposed solutions to conflicts in the table.
Task 3	Leads comapring results.	Compare the results, make and evaluate conclusions.
Implementation risks		The teacher warns the students that they must follow traffic regulations in their work. The teacher warns the students that they should not approach the shore at a distance that still allows for safe work (preventing the risk of slipping into the river).
Note: /		

Key to the worksheet: /

Urban river banks - activities and conflicts

Many towns have found a place along the rivers. Rivers were once, even more than today, the source and sometimes even the condition of life and development in cities. Maribor was also built on a small part along the Drava River, where the hills of the Slovenske Gorice hills to the north and the Drava River bed to the south provided protection.

Today, from the point of view of the population, the river and the riverside area are primarily places of relaxation, recreation and enjoyment. But they used to be many other things. The power of the Drava powered mills and water was also used in households. In the past, before the construction of hydroelectric power stations, the Drava was a transport route used to transport timber on rafts to the Podravina in Croatia. Throughout history, the Drava has also been an inspiration for artists.

But the coexistence of the city and the river has not always been pleasant. In the second half of the 20th century, the city turned its face away from the river. This period was marked by the rapid growth of the city's population and the accelerated expansion of the city, especially its industry, with its many negative effects on the Drava river. Maribor was considered one of the largest industrial centres in the former Yugoslavia. Due to its low ecological standards, the river was a drainage channel for municipal and industrial waste water, which led to a significant deterioration in the quality of the water. From the 1990s onwards, the construction of sewage treatment plants and the discharge of industrial and municipal sewage to the central sewage treatment plant in Dogoše have led to a significant improvement in the quality of the Drava's water. Today, the use of the Drava riverbank in Maribor is very diverse, and there is still a confluence of activities that are incompatible or even mutually exclusive.

The aim of our exercise is to record the activities along the Drava River in a selected section (left bank, between the Court Tower and the Tito's Bridge), to detect the areas where conflicts between these activities occur and to try to find solutions in space to eliminate these conflicts.

Instructions

The area to be covered includes the area on the left bank of the Drava between the Court Tower and the Tito's Bridge. On the map it is bounded to the south by the Drava river bank, to the north by the buildings along the river bank, and to the east and west by two thickened vertical arrows. The house numbers of the buildings are also marked on the map to help orientation.

A. In the field, we will first record the activities in the area under consideration and plot them on the map using different colours in the form of lines parallel to the river bed. In some sections, several activities will occur simultaneously. In these areas, parallel lines will be drawn on the map with the appropriate colours.

Legend for plotting activities on the Drava river bank:

1. tourism and hospitality	red
2. recreation	green
3. industry	black
4. administration, offices	yellow
5. residential areas	blue
6. transport (with parking lots)	purple
7. other	brown

B. On the basis of the map (Map 1: Drava river bank), let's try to find out whether there are conflicts between different activities in the area.

Indicate the conflict areas on the map with consecutive numbers and list the activities that cause conflict in the table attached (Table 1: Conflict activities on the Drava river bank and solutions). Take photographs of these areas using your smartphones.

Try to justify your ideas about the conflict zones.

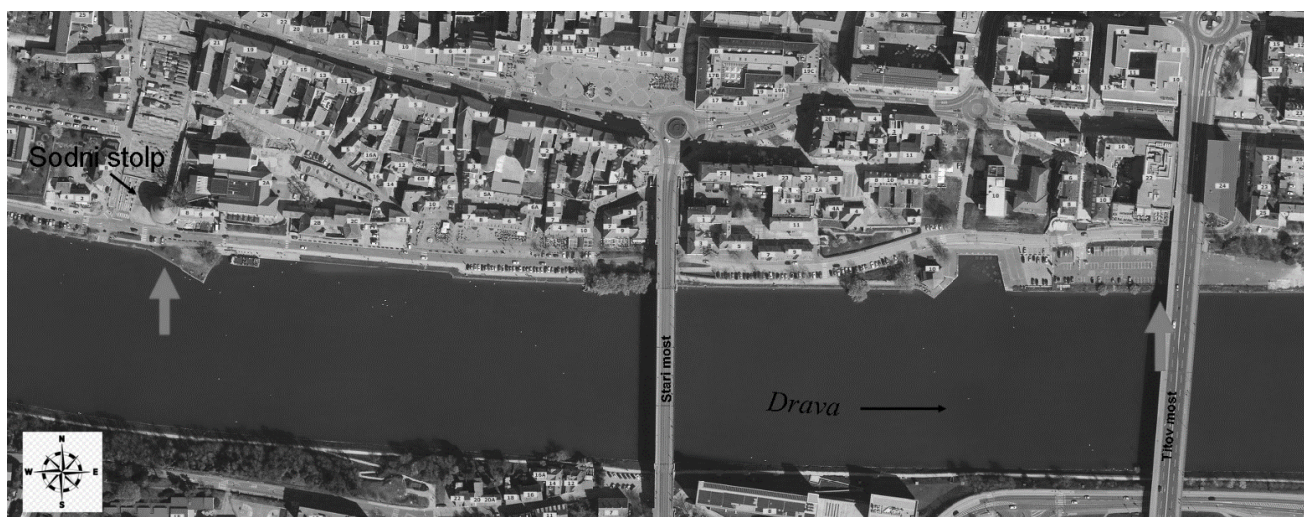
What are the results of the conflict activities (e.g. reduced quality of the living environment, negative effects on flora and fauna, visual degradation, reduced earnings, etc.)?

Which entities are negatively affected by conflict activities (e.g. residents, animals, plants, water, air, businesses, etc.)?

C. Suggest some measures to reduce or eliminate conflicts in specific areas. Write Your solutions in Table 1.

Consider also which values you will uphold in your proposals to eliminate conflicts.

Map 1: Drava river bank.



Note:

Vertical arrows mark the western and eastern boundaries of the research area.

Table 1: Conflict activities on the Drava river bank and solutions

No.	Conflict activities	Solutions
1.		
2.		
3.		
4.		
5.		

6.		
7.		
8.		

Activity 14 - Creative measuring latitude

Theme	Creative measuring latitude
Topic (Curriculum)	Elementary School: / GIM and other secondary schools: General Geography - introductory topics
Target group	ISCED3 (age: 15)
Duration (outdoor, indoor part)	45 minutes of preparation in class, 90 minutes of field work, 45 minutes of analysis and synthesis in class
Cross-curricular links	Technics, physics, mathematics, informatics
Organizational forms	Preparation - frontal work, implementation in the field - work in groups, synthesis-frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching aids	Inclinometer, tripod, table, pen
Place of realisation	School surroundings
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for field work is required. It is necessary to make an inclinometer. Attaching the inclinometer to a tripod is also recommended.
Objectives of the activity	<ul style="list-style-type: none"> - With the help of their own measurements of the height of the Sun (the Polaris Star or the given star) at the time of the upper culmination, the students themselves determine the latitude of the observation site.
Theoretical basis	<p>Determining geographic latitude using the height of the Sun, the Polaris star, or given star has been a popular method of determining the geographic latitude of a given location since the beginning of the development of navigation. Here, the height of the Sun, the Polaris star or a given star at the time of the upper culmination and the declination of this object enter as input variables.</p> <p>The geographic latitude is calculated using the formula:</p> $\phi = 90^\circ - h \pm \delta$ <p>ϕ – geographic latitude of the site (°)</p>

	<p>h – height of the Sun (Polaris star or the given star) at the time of the upper culmination ($^{\circ}$)</p> <p>δ – declination during observation ($^{\circ}$)</p> <p>When determining the geographic latitude, we must also take into account that the Sun does not always reach its upper culmination at 12 o'clock (at 1 p.m. during summer time), but it can be a little earlier or later. The time difference between the time of the upper culmination of the Sun and 12 o'clock is called the time equation (η). The actual time of the upper culmination (T_k) is calculated according to the following formula:</p> $T_k = 12h - \eta$ <p>The change in the time equation during year is a function of the eccentricity of the Earth's orbit around the Sun and the inclination of the ecliptic relative to the plane of the celestial equator. Data on the equation of time (η) for each day of the year are available in Appendix 1.</p>
Conclusion (evaluation)	Students compare their own results with latitude data obtained with the help of a smartphone or Geopedia or Google Earth.

Individual approach suggestions	Talented student	Less-gifted student
	Students take several measurements at different locations.	Students only do latitude determination using the Sun.
	Students compare the results of their own measurements with latitude data obtained using a smartphone or Geopedia or Google Earth.	

Activity scenario	Teacher activities	Students' activities
task 1	<p>Preparation for fieldwork:</p> <ul style="list-style-type: none"> • explanation of theoretical foundations, review of the worksheet, dividing students into pairs or groups. 	<ul style="list-style-type: none"> • Get to know or brush up on general issues in the field of general geography • review the required work procedures, divide into groups, mark their group's research area on the map.

task 2	Leads the students to a common starting point (agreement on meeting point).	For the selected date, they calculate the time of the upper culmination of the Sun. In doing so, they take into account the value of the time equation (Appendix 1) for that day.
task 3	Monitors the work of the groups and advises if necessary.	They determine the declination of the Sun for the selected date (Appendix 2).
task 4	Monitors the work of the groups and advises if necessary.	During the upper culmination of the Sun, the height of the Sun is measured with an inclinometer.
task 5	Monitors the work of the groups and advises if necessary.	They calculate the latitude, taking into account the declination of the Sun for that day and the measured height of the Sun using an inclinometer. If necessary, the measurements are repeated using the Polaris star or a given star, following the instructions in the worksheet.
Implementation risks		When making an inclinometer, students must be reminded of all the necessary measures to ensure safety at work.
Note: /		

Key to the worksheet: /

Creative measuring the geographical latitude

To calculate latitude (ϕ), we need data on the height of the Sun at the time of the upper culmination (h) and the declination of the Sun at the time of measurement of the height of the Sun (δ). The procedure for measuring latitude is as follows:

1. For the selected date, we calculate the time of the upper culmination of the Sun. Let's take into account the value of the time equation (Appendix 1) for that day.
2. Determine the declination of the Sun for the selected date (Appendix 2)
2. During the upper culmination of the Sun, measure the height of the Sun with an inclinometer
3. We calculate the latitude, taking into account the declination of the Sun for that day and the measured height of the Sun using an inclinometer

Due to the uneven movement of the Earth around the Sun, this sometimes culminates before and sometimes after 12 o'clock.

The time difference between the time of the upper culmination of the Sun and 12 o'clock is called the time equation (η). The actual time of the upper climax (T_k) is calculated according to the following formula:

$$T_k = 12h - \eta$$

The change in the equation of time during year is a function of the eccentricity of the Earth's orbit around the Sun and the inclination of the ecliptic relative to the plane of the celestial equator. Data on the equation of time (η) for each day of the year are available in Appendix 1.

The declination of the Sun varies from $+23.5^\circ$ to -23.5° during the year. Information on the daily declination of the Sun is available in Appendix 2.

The geographic latitude is calculated using the formula

$$\phi = 90^\circ - h \pm \delta$$

ϕ – geographic latitude of the site ($^\circ$)

h – height of the Sun at the time of observation ($^\circ$)

δ – declination during observation ($^\circ$)

The end result is the average of all measured/calculated latitudes.

The data are recorded in the following table:

DATE	TIME EQUATION (η)	DECLINATION OF THE SUN (δ)	TIME OF THE UPPER CULMINATION OF THE SUN ($T_k = 12h - \eta$)	HEIGHT OF THE SUN ($^\circ$)	GEOGR. LATITUDE ($\phi = 90^\circ - h \pm \delta$) ($^\circ$)

The sun's altitude will be measured using an inclinometer. Glue on to the board or thick plywood the slope base previously printed on A4 format paper (the slope printing base is in Appendix 3) so that the

base of the inclinometer is parallel to the levelling top plane of the board. In the starting point of the incline, we nail a small tack on which we hang a string that we weight.

The inclinometer can be held in the hand, and it is even more comfortable to measure if the inclinometer is attached to a tripod or similar device. It will be easier to measure if the solar disc is wrapped with welding glass (optical density above 12) or even a mylar foil made for this purpose.



Figure 1: Measurement of the height of the Sun with inclinometer.

Align the upper edge of the inclinometer with the center of the solar disk. The angle between the vertical and the arm connecting the starting point of the inclination marked 90° is the height of the Sun. We measure to the nearest 0.5° .

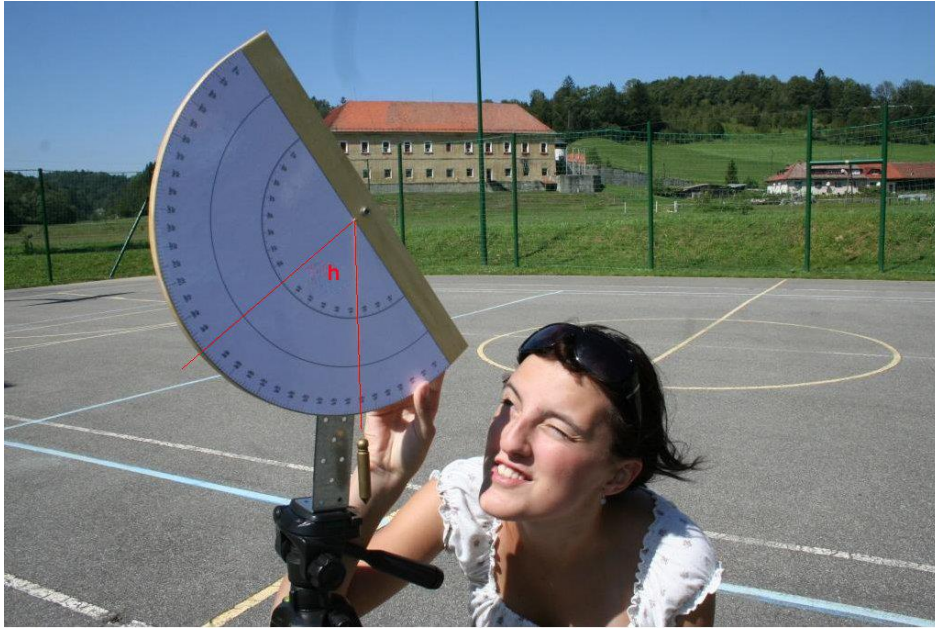


Figure 2: Measurement of the height of the Sun with inclinometer.

Calculate geographic latitude by formula

$$\phi = 90^\circ - h \pm \delta$$

ϕ – geographical latitude of the site (°)

h – height of the Sun at the time of observation (°)

δ – declination at the time of observation (°)

To determine latitude, we can also use the Polaris star, which is located about 1° away from the north celestial pole. The elevation angle of the North Pole is also an angle equal to the geographic latitude of the observatory (at the North Pole, the Polaris star is at the zenith, and at the equator, at the mathematical horizon).

Instead of the Polaris star, we can also use any star that is visible to the naked eye. At the time of its upper culmination, we measure its elevation angle, write down the information about its declination, and then calculate the latitude according to the following formula:

$$\phi = 90^\circ - h \pm \delta$$

ϕ – geographical latitude of the Observatory (°)

h – elevation angle of the stars at the time of its upper cul (°)

δ – star declination (°)

Information about the time of upper culmination of stars can be found in free programs such as Sky Chart (for MS Windows)¹, on the Heavens Above website² Mobile Observatory, Night Sky Tools, Sky Safari, and SkEye (for Android).

¹ <https://www.ap-i.net/skychart/en/start>

² <https://www.heavens-above.com/>

Appendix 1:

Time equation values (η) for every day into Year

Day	JAN	FEB.	MAR	APR	MAY	JUN	JUL	AVG	SEP	OCT.	NEW	DEC
1	-3:12	-13:33	-12:34	-4:08	+2:51	+2:25	-3:33	-6:16	-0:12	+10:05	+16:20	+11:11
2	-3:40	-13:41	-12:23	-3:50	+2:59	+2:16	-3:45	-6:13	+0:07	+10:24	+16:22	+10:49
3	-4:08	-13:48	-12:11	-3:32	+3:06	+2:06	-3:57	-6:09	+0:26	+10:43	+16:23	+10:26
4	-4:36	-13:55	-11:58	-3:14	+3:12	+1:56	-4:08	-6:04	-0:45	+11:02	+16:23	+10:02
5	-5:03	-14:01	-11:45	-2:57	+3:18	+1:46	-4:19	-5:59	-1:05	+11:20	+16:22	+9:38
6	-5:30	-14:06	-11:31	-2:40	+3:23	+1:36	-4:29	-5:53	+1:25	+11:38	+16:20	+9:13
7	-5:57	-14:10	-11:17	-2:23	+3:27	+1:25	-4:39	-5:46	+1:45	+11:56	+16:18	+8:48
8	-6:23	-14:14	-11:03	-2:06	+3:31	+1:14	-4:49	-5:39	+2:05	+12:13	+16:15	+8:22
9	-6:49	-14:16	-10:48	-1:49	+3:35	+1:03	-4:58	-5:31	+2:26	+12:30	+16:11	+7:56
10	-7:14	-14:18	-10:33	-1:32	+3:38	+0:51	-5:07	-5:23	+2:47	+12:46	+16:06	+7:29
11	-7:38	-14:19	-10:18	-1:16	+3:40	+0:39	-5:16	-5:14	+3:08	+13:02	+16:00	+7:02
12	-8:02	-14:20	-10:02	-1:00	+3:42	+0:27	-5:24	-5:05	+3:29	+13:18	+15:53	+6:34
13	-8:25	-14:19	-9:46	-0:44	+3:44	+0:15	-5:32	-4:55	+3:50	+13:33	+15:46	+6:06
14	-8:48	-14:18	-9:30	-0:29	+3:44	+0:03	-5:39	-4:44	+4:11	+13:47	+15:37	+5:38
15	-9:10	-14:16	-9:13	-0:14	+3:44	-0:10	-5:46	-4:33	+4:32	+14:01	+15:28	+5:09
16	-9:32	-14:13	-8:56	+0:01	+3:44	-0:23	-5:52	-4:21	+4:53	+14:14	+15:18	+4:40
17	-9:52	-14:10	-8:39	+0:15	+3:43	-0:36	-5:58	-4:09	+5:14	14:27	+15:07	+4:11
18	-10:12	-14:06	-8:22	+0:29	+3:41	-0:49	-6:03	-3:57	+5:35	+14:39	+14:56	+3:42
19	-10:32	-14:01	-8:04	+0:43	+3:39	-1:02	-6:08	-3:44	+5:56	+14:51	+14:43	+3:13
20	-10:50	-13:55	-7:46	+0:56	+3:37	-1:15	-6:12	-3:30	+6:18	+15:02	+14:30	+2:43
21	-11:08	-13:49	-7:28	+1:00	+3:34	-1:28	-6:15	-3:16	+6:40	+15:12	+14:16	+2:13
22	-11:25	-13:42	-7:10	+1:21	+3:30	-1:41	-6:18	-3:01	+7:01	+15:22	+14:01	+1:43

23	-11:41	-13:35	-6:52	+1:33	+3:24	-1:54	-6:20	-2:46	+7:22	+15:31	+13:45	+1:13
24	-11:57	-13:27	-6:34	+1:45	+3:21	-2:07	-6:22	-2:30	+7:43	+15:40	+13:28	+0:43
25	-12:12	-13:18	-6:16	+1:56	+3:16	-2:20	-6:24	-2:14	+8:04	+15:47	+13:11	+0:13
26	-12:26	-13:09	-5:58	+2:06	+3:10	-2:33	-6:25	-1:58	+8:25	+15:54	+12:53	-0:17
27	-12:39	-12:59	-5:40	+2:16	+3:03	-2:45	-6:25	-1:41	+8:46	+16:01	+12:34	-0:47
28	-12:51	-12:48	-5:21	+2:26	+2:56	-2:57	-6:24	-1:24	+9:06	+16:06	+12:14	-1:16
29	-13:03	-12:42	-5:02	+2:35	+2:49	-3:09	-6:23	-1:07	+9:26	+16:11	+11:54	-1:45
30	-13:14		-4:44	+2:43	+2:41	-3:21	-6:21	-0:49	+9:46	+16:15	+11:33	-2:14
31	-13:24		-4:26		+2:33		-6:19	-0:31		+16:18		-2:43

Appendix 2:

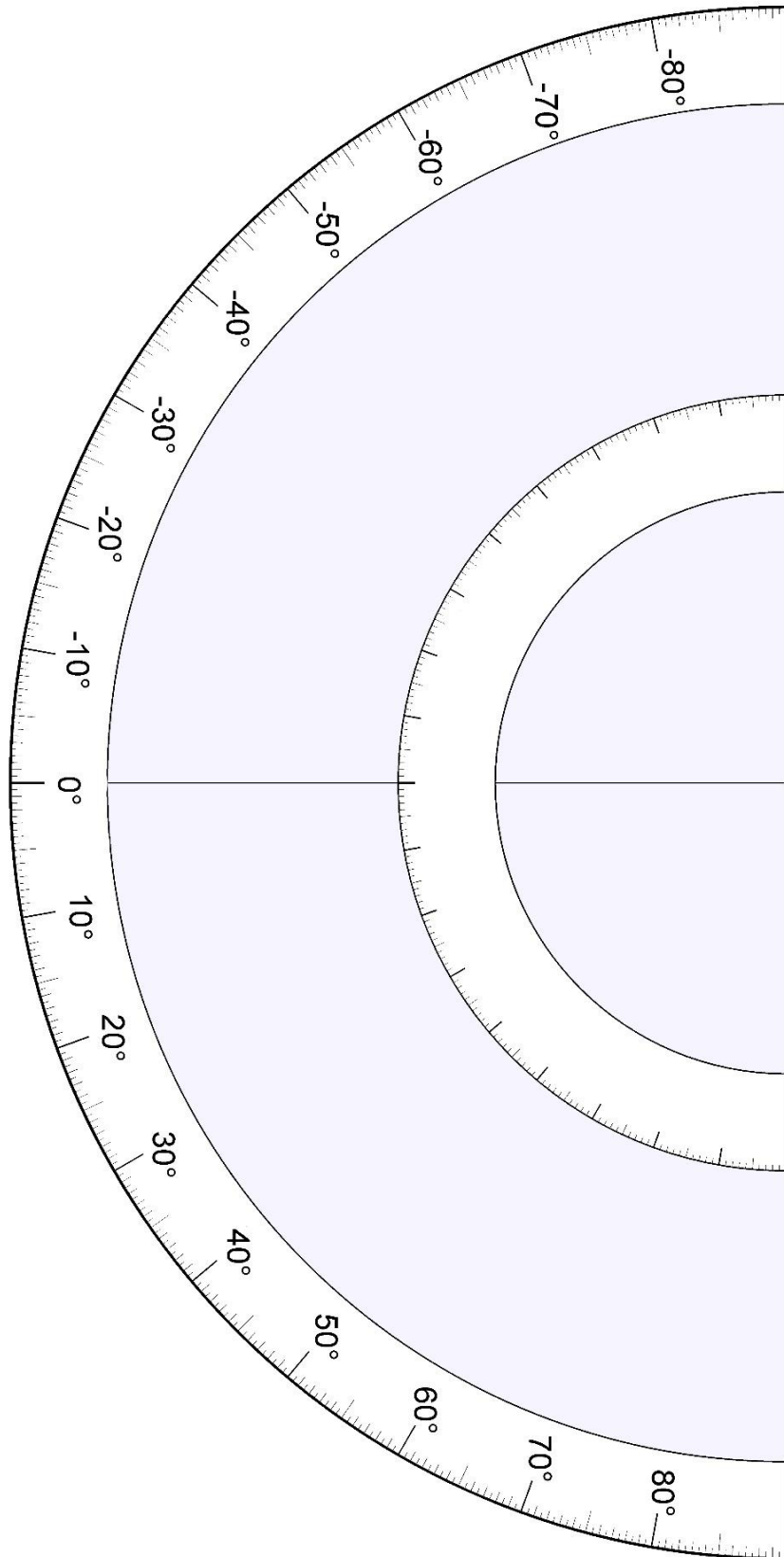
Declination values (δ) for every day into Year

Day	JAN	FEB.	MAR	APR	MAY	JUN	JUL	AUG	SEP	Oct.	NEW	DEC
1	-23°04'	-17°20'	-7°49'	+4°18'	+14°54'	+21°58'	+23°09'	+18°10'	+8°30'	-2°57'	-14°14'	-21°43'
2	-22°59'	-17°03'	-7°26'	+4°42'	+15°12'	+22°06'	+23°05'	+17°55'	+8°09'	-3°20'	-14°34'	-21°52'
3	-22°54'	-16°46'	-7°03'	+5°05'	+15°30'	+22°14'	+23°01'	+17°40'	+7°47'	-3°44'	-14°53'	-22°01'
4	-22°48'	-16°28'	-6°40'	+5°28'	+15°47'	+22°22'	+22°56'	+17°24'	+7°25'	-4°07'	-15°11'	-22°10'
5	-22°42'	-16°10'	-6°17'	+5°51'	+16°05'	+22°29'	+22°51'	+17°08'	+7°03'	-4°30'	-15°30'	-22°18'
6	-22°36'	-15°52'	-5°54'	+6°13'	+16°22'	+22°35'	+22°45'	+16°52'	+6°40'	-4°53'	-15°48'	-22°25'
7	-22°28'	-15°34'	-5°30'	+6°36'	+16°39'	+22°42'	+22°39'	+16°36'	+6°18'	-5°16'	-16°06'	-22°32'
8	-22°21'	-15°15'	-5°07'	+6°59'	+16°55'	+22°47'	+22°33'	+16°19'	+5°56'	-5°39'	-16°24'	-22°39'
9	-22°13'	-14°56'	-4°44'	+7°21'	+17°12'	+22°53'	+22°26'	+16°02'	+5°33'	-6°02'	-16°41'	-22°46'
10	-22°05'	-14°37'	-4°20'	+7°43'	+17°27'	+22°58'	+22°19'	+15°45'	+5°10'	-6°25'	-16°58'	-22°52'
11	-21°56'	-14°18'	-3°57'	+8°07'	+17°43'	+23°02'	+22°11'	+15°27'	+4°48'	-6°48'	-17°15'	-22°57'
12	-21°47'	-13°58'	-3°33'	+8°28'	+17°59'	+23°07'	+22°04'	+15°10'	+4°25'	-7°10'	-17°32'	-23°02'
13	-21°37'	-13°38'	-3°10'	+8°50'	+18°14'	+23°11'	+21°55'	+14°52'	+4°02'	-7°32'	-17°48'	-23°07'
14	-21°27'	-13°18'	-2°46'	+9°11'	+18°29'	+23°14'	+21°46'	+14°33'	+3°39'	-7°55'	-18°04'	-23°11'
15	-21°16'	-12°58'	-2°22'	+9°33'	+18°43'	+23°17'	+21°37'	+14°15'	+3°16'	-8°18'	-18°20'	-23°14'
16	-21°06'	-12°37'	-1°59'	+9°54'	+18°58'	+23°20'	+21°28'	+13°56'	+2°53'	-8°40'	-18°35'	-23°17'
17	-20°54'	-12°16'	-1°35'	+10°16'	+19°11'	+23°22'	+21°18'	+13°37'	+2°30'	-9°02'	-18°50'	-23°20'
18	-20°42'	-11°55'	-1°11'	+10°37'	+19°25'	+23°24'	+21°08'	+13°18'	+2°06'	-9°24'	-19°05'	-23°22'
19	-20°30'	-11°34'	-0°48'	+10°58'	+19°38'	+23°25'	+20°58'	+12°59'	+1°43'	-9°45'	-19°19'	-23°24'
20	-20°18'	-11°13'	-0°24'	+11°19'	+19°51'	+23°26'	+20°47'	+12°39'	+1°20'	-10°07'	-19°33'	-23°25'
21	-20°05'	-10°52'	0°00'	+11°39'	+20°04'	+23°26'	+20°36'	+12°19'	+0°57'	-10°29'	-19°47'	-23°26'
22	-19°52'	-10°30'	+0°24'	+12°00'	+20°16'	+23°26'	+20°24'	+11°59'	+0°33'	-10°50'	-20°00'	-23°26'

23	-19°38'	-10°08'	+0°47'	+12°20'	+20°28'	+23°26'	+20°12'	+11°39'	+0°10'	-11°12'	-20°13'	-23°26'
24	-19°24'	-9°46'	+1°11'	+12°40'	+20°39'	+23°25'	+20°00'	+11°19'	-0°14'	-11°33'	-20°26'	-23°26'
25	-19°10'	-9°24'	+1°35'	+13°00'	+20°50'	+23°24'	+19°47'	+10°58'	-0°37'	-11°54'	-20°38'	-23°25'
26	-18°55'	-9°02'	+1°58'	+13°19'	+21°01'	+23°23'	+19°34'	+10°38'	-1°00'	-12°14'	-20°50'	-23°23'
27	-18°40'	-8°39'	+2°22'	+13°38'	+21°12'	+23°21'	+19°21'	+10°17'	-1°24'	-12°35'	-21°01'	-23°21'
28	-18°25'	-8°17'	+2°45'	+13°58'	+21°22'	+23°19'	+19°08'	+9°56'	-1°47'	-12°55'	-21°12'	-23°19'
29	-18°09'	-8°03'	+3°09'	+14°16'	+21°31'	+23°16'	+18°54'	+9°35'	-2°10'	-13°15'	-21°23'	-23°16'
30	-17°53'		+3°32'	+14°35'	+21°41'	+23°13'	+18°40'	+9°13'	-2°34'	-13°35'	-21°33'	-23°12'
31	-17°37'		+3°55'		+21°50'		+18°25'	+8°52'		-13°55'		-23°08'

Appendix 3:

Incline stencil



Activity 15 - Burdening agro-ecosystems

Theme	Burdening agro-ecosystems
Topic (Curriculum)	Primary school: /
	Secondary school: agriculture, sustainable development, regional and environmental contradictions in Slovenia
Target group	ISCED3 (age: 15, 18)
Duration (outdoor, indoor part)	45 minutes of preparation in class, 90 minutes of fieldwork, 45 minutes of analysis and synthesis in the classroom
Cross-curricular links	Technology, biology, mathematics, chemistry, physics, informatics.
Organizational forms	Preparation-frontal work, field-work in groups, synthesis-frontal work
Staffing	Geography teacher (accompanying teacher if the norm of the number of students is exceeded)

Teaching AIDS	Poll, map, smartphone, pen.
Place of realisation	The task is suitable for a rural settlement.
Environment's specifics	

Required entry knowledge and skills of students	Substantive preparation for fieldwork is required. Basic digital competences are needed (working with smartphone, camera).
Objectives of the activity	<ul style="list-style-type: none"> - They survey agricultural households and recalculate the data according to the instructions in the exercise, - they analyze the level of strain on agroecosystems due to material and energy inputs into the environment on farms.
Theoretical basis	After The Second World War, agricultural treatment on arable land was intensive and specialised. The result of all these changes is that the burden on the environment is increasing and therefore agricultural activity has an indirect impact on the transformation of our environment. The most intensive agricultural production takes place in fields, vineyards and orchards, making them the most vulnerable areas. As a result, there are already conflicts of interest between agricultural production and environmental protection. The cause of concern is mainly the large reserves of groundwater in the flat part, which, due to the increased use of plant protection agents and excessive fertilisation, are becoming increasingly at risk, but we are not aware of the consequences that will also reach the population over time and affect the quality of our lives. More recently,

	<p>therefore, they add value to organic farming, which in some way protects the environment. Intensive production with strict specialisation brings high yields and, on the other hand, leads to greater negative environmental impacts. In this day, it is an alarming issue to burden the environment by human beings in an indirect or direct manner through agricultural activity. Agriculture has shifted from extensive to intensive in recent decades, which only increases the burden on agro-ecosystems, as this transition is linked to the increased use of machinery and the consumption of plant protection products and mineral fertilisers, which is why the greatest environmental burden is concentrated on fields and wine-growing areas.</p> <p>The appropriate method for determining environmental pollution from agriculture was developed in 1975 by Scottish energy analyst Malcolm Slessor, who calculated energy density based on energy inputs and associated arable land. Energy density tells us how much agricultural activity invests energy and matter per hectare of arable land. In the calculation, we take into account all direct inputs into the environment (mineral fertilisers, protective agents, electricity, liquid derivatives) and convert them to the common denominator in GJ (gigajoule) using energy equivalents and express uniformly on gigajoules per hectare (GJ/ha). In this way, the intensity of individual farming holdings or the wider agrarian environment can be established fairly quickly.</p> <p>According to his own research, Slessor divided the agricultural activity into several energy levels and came to the conclusion that agricultural activity does not pollute the environment or does not spread the load outside the farm in the event of consumption of less than 15 GJ of energy per hectare of arable land. This method provides indicative results of the load, since the actual environmental burden depends on a number of natural and social factors (e.g. self-cleaning capacity, environmental sensitivity, climate, soil, land use change...).</p>
Conclusion (evaluation)	Students analyse the level of burden on agro-ecosystems according to the size of the farm, depending on its orientation and its position (lowlands, hills, mountains). They seek to explain the causes of differences in the level of burden on agro-ecosystems and propose solutions to reduce pollution.

Individual approach suggestions	Talented student	Less-gifted student
	They do research in a larger area.	They do a survey in a smaller area.
	They analyse the structure of the material-energy inputs.	They do a small number of surveys.
	They prepare a cartographic presentation of the results and compare their own results with already published in the scientific literature.	

scenario Activity	Teacher activities	Students' activities
task 1	Preparation for fieldwork: <ul style="list-style-type: none"> an explanation of theoretical basics, a review of the worksheet, the division of pupils into doubles or groups, the division of the area into research zones of individual groups, the management of the security plan. 	<ul style="list-style-type: none"> they get to know or refresh the general problem of pollution caused by agriculture, review the worksheet and the required work procedures are divided into groups, indicate on the map the research area of their group.
task 2	He leads the students to a common starting point (agreement on the collection point).	Get ready for field work.
task 3	It shall monitor the work of the teams and, if necessary, advise.	Pupils carry out a survey.
task 4	It shall monitor the work of the teams and, if necessary, advise.	Pupils calculate material energy inputs using energy equivalents in GJ.
task 5	It shall monitor the work of the teams and, if necessary, advise.	Pupils shall calculate the energy density level on individual farms in GJ/ha and identify differences and causes of differences in the level of load on individual farms.
Implementation risks		Pupils should be reminded of compliance with traffic regulations when moving on the ground and attitudes towards those surveyed.
Note: /		

Key to the worksheet: /

Burdening agroecosystems

Agriculture is an activity that deals with the production of food. It depends on the natural conditions that in Slovenia they are not the most favorable, mainly because of the high altitudes and steepness slopes.

After the Second World War, agriculture was transformed from extensive to intensive agriculture, which means the production of agricultural products with increased use of agricultural machinery, mineral fertilizers and phytopharmaceutical preparations. All of this has an impact on the increased burden on the environment. Areas with extensive cultivated areas are most at risk, especially if they are located near water sources. This applies mainly to the flat areas of Slovenia in northeastern Slovenia – Podravje and Pomurje, as well as the Ljubljana and Celje basins. This is where the conflicts between agricultural production and environmental protection are greatest.

In recent decades, the use of phytopharmaceutical preparations for plant protection and artificial and mineral fertilizers has been increasing. Mineral fertilizers are mainly used in agriculture in order to provide the plants with enough mineral substances during the growing season, which they need for their growth, and artificial fertilizers are mainly replaced with stable manure. Phytopharmaceutical preparations protect plants from pests that can destroy them in vegetation period. Due to the increasing use of these funds, which are the result of petrochemical industry and the desire for the highest possible yield per hectare, the environment is increasingly burdened. Nobody is not aware of the actual consequences that such behavior brings us, but development of Slovenian agriculture should go mainly in the direction of nature conservation and bio-agriculture. Another trend is present in agriculture: at the expense of the lower part of "living work", the use of machines and the related consumption of anthropogenic energy is increasing, replacing the use of solar energy and the use of human muscles. In this way, agriculture also contributes to environmental pollution, although not always necessarily »in situ«.

Agricultural environmental impact can be measured in two ways. In the first way with actual measurements of the pollution of a certain element of the agrarian environment (water, soil, atmosphere). In this way we would get certain data, but it would take a lot of time, and also the

equipment you would need for this is very expensive. Therefore, in practice, we are offered another one an option that is much simpler, but the results obtained in this way are not so exact, but only approximations. This methodology was best adhered to by the British ecologist Slesser, who considers the strain on agroecosystems in the light of the energy intensity of agriculture itself, i.e. with material and energy inputs on the farm, which it compares with the cultivated areas (owned and rented) managed by this farm. It calculates the material-energy inputs to the common denominator using the assessment of energy equivalents for each input. This makes it possible to express different material and energy inputs on the farm uniformly, in gigajoules per hectare of cultivated area (GJ/ha). With this, in a relatively simple form, it is possible to express not only the intensity of individual farms, but of agriculture in general, and to compare it with each other. According to Slesser's assessment, 15 GJ of energy per hectare of arable land is the limit above which we can already talk about pollution of agroecosystems. Material and energy inputs on the farm exceed self-cleaning capabilities. Of course, this limit is set only approximately. The actual self-cleaning abilities of individual regions differ.

The disadvantage of this method is that data for individual farms can only be obtained with the help of surveys. In the surveys in which farmers participate, we get data expressed in different units: liters (petroleum, gasoline, protective agents, fuel oil), m³ (manure, slurry), kg (mineral fertilizers, natural gas, manure), kWh (electricity). We must convert all this data into a common unit of joules in order to be able to calculate the energy intensity of individual farms. When calculating the data obtained from the survey, we used the values shown in Table 1. Based on these values, we can calculate the energy intensity of an individual farm and compare the obtained data with already existing data on the energy intensity of the considered areas.

Table 1: Energy equivalent values of each material-energy inputs

Matter	Energy equivalent
1 kg beef manure	0.2668 MJ
1 kg mineral fertiliser (NPK)	6.67 MJ
1 m ³ natural manure	260 MJ
1 m ³ Slurry	193 MJ
1 kg Compost	4.7 MJ
1 kg mineral fertilisers (average)	19.7 MJ
1 kg protective means	110 MJ
1 kg Urea	10,5 MJ
1 kg KAN	57 MJ
1 kg To	9.6 MJ
1 kg P	14 MJ
1 kg N	67 MJ
1 tone of slurry (average, actually dependent on N share)	268 mj
1 kg oil, gas or fuel oil	46 MJ
1 l gasoline or mixtures	42 MJ
1 kWh of electricity	14 MJ
1 gas cylinder	57.2 MJ
1 m ³ natural gas	45,5 MJ

A few more converters:

1 GJ = 1,000 mj

1 MJ = 1,000,000 J
 1 kcal = 4186.8 J
 1 J = 0.238 cal
 1 cal = 4.1868 J

Example of calculated farm energy consumption:

The given farm has 12,5 ha arable land (own and rented). Within a year, this farm had consumed:

- all natural manure of his own herd (2190 kg)
- 7200 kg fertiliser (NPK)
- 6500 kg Urea
- 170 kg protective agents (pesticides, herbicides, etc.)
- 6200 l Oil
- 1200 l Gasoline
- 1680 kWh of electricity

The annual energy consumption was therefore:

Matter	Quantity	Energy equivalent	Quantity x Energ.ekviv. (Total)	%
Natural manure	2190 kg	260 MJ	569 MJ	0,1
Mineral fertilisers	7200 kg	6.67 MJ	48,240 MJ	9,8
Urea	6500 kg	10,5 MJ	68,575 MJ	13,8
Protective agents	170 kg	110 MJ	18,700 MJ	3,8
Petroleum	6200 l	46 MJ	285,200 MJ	57,6
Petrol	1200 l	42MJ	50,400 MJ	10,2
Electricity	1680 kWh	14 MJ	23,520 MJ	4,7
TOGETHER			495 204 MJ	100,0

The farm consumed 495.2 GJ of energy per area per year 12.5 ha, which gives an energy load of 39,6 GJ/ha.

Subtracting electricity that does not pollute the specific environment and most of the petrol used for a passenger car remains or decreases energy consumption to 471.7 GJ or 37.7 GJ/ha.

The calculation shows that this is an intensive farm, which no longer protects the environment but already threatens or overburdens it.

Several variants of agro-ecosystem load analysis are possible:

- in the same village we survey larger, medium and small farms with the same orientation (farming, livestock farming, fruit growing, viticulture, forestry) and compare them with one in terms of energy density
- in the same settlement we survey farms with different orientations of activities (agriculture, livestock farming, fruit growing, viticulture, forestry) and compare them with each other in terms of energy density

- in different settlements according to altitude (lows, hills, low hills, high hills-above 1000 m) we compare similarly large farms, or farms with a similar orientation

Annex 1: Agro-ecosystem burden survey

Settlement:

House number:

Interview date:

1. Size of the holding and number of plots of each land group.

	2022	
	Ha	No. parcel
fields and gardens		
meadow		
pasture		
vineyard		
orchard		
forest		
marsh		
infertile		

2. Annual amount and type of mineral fertilisers consumed (as a rule for the last year, may also be for a multi-annual average)

Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>

3. Other special fertilisers:

Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity (kg)	<input type="text"/>

4. Annual quantity and type of natural manure consumed (bovine, pig, equine, hen, mixed) in tonnes, m³, wagons, tanks, etc. (units attributable !):

Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>

5. Annual amount of liquid fuel consumed (oil, heating oil, petrol, etc.) (units attributable):

Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>

6. Annual gas consumed (units attributable):

Year	<input type="text"/>	Quantity	<input type="text"/>
------	----------------------	----------	----------------------

7. Annual amount of electricity consumed (kWh):

Year	<input type="text"/>	Quantity	<input type="text"/>	or:
Month	<input type="text"/>	Quantity	<input type="text"/>	

8. Annual use of phytopharmaceutical preparations (units attributable):

Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>
Year	<input type="text"/>	Type	<input type="text"/>	Quantity	<input type="text"/>



Co-funded by the
Erasmus+ Programme
of the European Union



© LIFEdu team | <https://lifedu.upol.cz/>