USING SOCIO-SCIENTIFIC ISSUES IN STEAM PROJECT DAY - BASED ON THE EXAMPLE OF REID'S ROAD CONSTRUCTION DILEMMA IN TALLINN

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Time: ~ 4-6 hours

LEARNING ACTIVITY DESIGN

TOPIC: Forming an evidence-based opinion about Reidi road - Collecting, analysing and interpreting data for mapping the current environmental situation in the location of a planned Reidi road.

INTRODUCTION TO THE PROBLEM AND CONTEXT: Tallinn city government has given a green light to build a highway called Reidi road through the Russalka park, which will run along the beach of Tallinn bay from the intersection near Russalka till the intersection of Jõe and Ahtri street. The road will be 1,7 km long. The vision of the Reidi road has caused a lot of protest by different environmental organisations and city people mainly because of turning the current sandy beach and seaside park into a motor road, its large dimensions for transport, proximity to the beach, destruction of the greenery and a lost option to develop a seaside park between Russalka and Vanasadam and a promenade along the beach.

The planned Reidi road

Faktum & Ariko has studied people's attitudes and knowledge about the Reidi road situation.

The study showed that only 3% of the age group 15-24 was well informed about the situation and its problems, 69% of the people of this age group claimed to have any knowledge about the planned development and potential consequences. In order to form an opinion and perhaps to propose own solutions, one has to collect evidence and information about the topic. Thus, what is your vision of the development of Reidi road? What is the current situation with the environment in this area? How would the city development plan influence the area and would it make the situation worse?

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LEARNING GOALS:

To learn how to make and justify informed decisions about socio-environmental questions taking into account social and natural sciences concepts, as well as ethical values.

To acquire knowledge and procedural skills for carrying out problem-solving and scientific inquiry

To set research questions, plan experiment, analyse and interpret collected data and make conclusions from results

To gain knowledge about how to measure and analyze biological diversity, air quality, sound levels and water quality

To gain know-how of how to make use of technology for supporting scientific inquiry activities

To value the environment, sustainable and healthy lifestyle.

To learn how to design and create tracks with smartphones for outdoor location based activities.

Specific learning objectives and activities according to the subjects (related to the national curriculum):

Biology:

Values biodiversity and responds with responsibility and sustainably to different ecosystems and habitats.

Provides reasons about the dilemmas of biodiversity protection

Learning Activities:

Mapping plant diversity by square method in different locations

Assessing soil quality on the basis of invertebrate diversity

Geography:

Makes use of printed and digital maps, tables, charts, drawings, pictures and texts to find information, describe processes and phenomena, find links between them and draw conclusions

Finds weather data from the Internet without a description at a predetermined location

Learning activities:

Comparing digital map with charts and drawings. Finding and marking the right locations on the map for planned experiment

Gathering information about different locations and making conclusions.

Physics:

Knows what the pressure is and can draw conclusions on the basis of it.

Determines the concentration of ions in water by conduction of electricity

Understands the effect of sound on the environment

Measures temperature in different environments and locations (Thermal Education)

Learning Activities:

Measuring air pressure, temperature and wind to describe current weather conditions

Measuring the concentration of ions in the seawater in different locations to estimate pH levels, possible nutrition salt concentration to identify any pollution

Measuring sound levels and bird diversity connections

Chemistry:

Determination of the alkalinity / acidity of the environment and the conclusions to be drawn from it. Inorganic substances in the air - oxides, acids, atmospheric and environmental effects

Learning Activities:

Measuring pH in seawater

Gathering data about different ions in seawater

Integration with other subjects:

Language: making presentation

Mathematics: data analysis and conclusion drawing

Social sciences: interaction between society and the environment, informed and responsible decision-making

Art: putting together a presentation, presentation of research results, assessment of the beauty of nature in the course of research activities

Technology: the impact of human and engineering on the environment, the use of ICT tools

Physical education: walking and healthy lifestyle

SUPPORTING TOOLS: Mobile app Avastusrada, participants' own smartphones, Lego robots (can be replaced with Vernier data logger),

Sensors: Salinity, conductivity, temperature(2), pH(2), TRIS pH, turbidity, anemometer, barometer, dissolved oxygen, sound level sensor, relative humidity, light sensor, soil moisture sensor, infrared thermometer

(Data loggers and sensors can be replaced by any other brand devices, for example Globisens or other sensor types that are existing in school)

LEARNING AND TEACHING SCENARIO (birds-eye view):

IN THE CLASSROOM

Whole class activity

Introduction to the day and to the topic

Short overview of learning tools - Avastusrada, robots, sensors

Students division into groups, dividing topics between groups

Topics for groups:

Seawater quality based on ion concentration

Seawater quality based on turbidity and visual estimation of algae (turbidity)

Air quality based on lichen diversity (mapping lichen, with picture analysis)

Sound levels and its effect on bird diversity (sound level sensor, birdwatch app)

Sound levels and its effect on human health (Pulse, Blood pressure)

Soil quality based on invertebrate diversity, moisture and temperature.

Clean/Wastewater collection and analysis

Students are provided with information about whole project day problem and their topic that will support overall environmental estimation and related explanations to some concepts used

ACTIVITIES IN GROUPS

Students will form hypothesis and research questions

Teacher confirms their hypothesis and questions

Students make their action plan (the template for the elements of the plan will be provided), they plan their experiments, decide what they will have to measure, how and where

Students work with maps. Students are provided with maps about planned Reidi road location. They have to find locations where they will make measurements and mark them in Avatusrada

Teacher confirms the plan

OUTSIDE THE CLASSROOM

Activities in groups

Students proceed to conduct the experiments: collect data, carry out measurements with sensors and with other strategies in 3 different location points (chosen by the students themselves and marked as exact location points in Avastusrada)

IN THE CLASSROOM

Activities in groups

Groups analyse their collected data

Groups make presentation of their findings

Whole class activity

Groups present their findings and other groups collect the presented data as an additional material for forming their solution and vision

Activities in groups

Groups merge data and information gathered from other groups, estimate the current environmental situation at the planned Reidi Road location and provide their own solution (if there is still time)

Whole class activity

Groups present their vision and conclusions

Whole class activity

Whole class discussion, reflection & general conclusion drawing

Example instruction can be found here:
https://docs.google.com/document/d/10VkWZXhMKYpzPHtN2o5e23xNaIwyae8cZdbvKVATEiA/edit?usp=sharing