COMPENDIUM

EDU CHANGE

Making knowledge together addressing climate change through innovative place based education and blended learning

2019

content

HOW DO CLIMATE CHANGES AFFECT YOUR LOCAL AREA

Suggested age: 14-16 years
Activity duration: 150 minutes
Connection to other subjects: Geography, Biology, Digital competence, Social Science

SIMULATION GAME

Suggested age: 15-19 years
Activity duration: 90 minutes
Connection to other subjects: Geography, Ecology

WASTE AROUND US

Suggested age: 15-19 years
Activity duration: 90 minutes in class, 30-60 minutes data collection as homework.
Connection to other subjects: Geography, Informatics, Social studies, Mathematics

CLIMATE CHANGE – WE NEED TO ACT NOW

Suggested age: 15-18 years
Activity duration: 3 x 45 minutes
Connection to other subjects: Geography

CLIMATE CHANGE AND WATER

Suggested age: 8-9 years
Activity duration: 120 minutes
Connection to other subjects: Science, Social studies, English language

OCEAN INVISIBLE KILLERS

Suggested age: 12-14 years
Activity duration: 3 x 40 minutes
Connection to other subjects: Geography, Biology, Chemistry, Environmental science

STUDYING WATER ISSUES IN STUDENTS' OWN LIVING ENVIRONMENTS THROUGH THE STORYMAPS

Suggested age: 15-18 years
Activity duration: 240 minutes
Connection to other subjects: Geography, Geology, Biology, Social studies, Physics, Chemistry

EduChange is a short name for project titled „Making Knowledge Together - Addressing Climate Change Through Innovative Place Based Education and Blended Learning“.

Our aim is to innovate our way of teaching about Climate Change in both local and global perspectives via the field course methodology. Teaching and learning in the field is often rather traditional and teacher-led. Through EduChange we aim to transform field courses into innovative, creative learning environments in which teachers, students and pupils create knowledge together.

We believe that supporting innovation and creativity can easily be achieved via international partnerships and inter- and transdisciplinary approaches. Therefore, our consortium includes partners from various European countries (Czech Republic, The Netherlands, Norway and Malta) with various geography related backgrounds (environmental science, geography for teachers, urban geography, geoinformatics, biology, science teacher education, etc.) but with a common objective.

Our partnerships with local high-schools strengthen the role of higher education regionally as well as channel the knowledge from universities towards the public (i.e. with upper secondary school students). The place-based education adopted during the project assumes the creation of knowledge together – connecting scientific perspectives with local knowledge and daily experiences.

We strive for field courses that stimulate deeper learning. We achieve this by a student-centred approach and a well balanced mix of innovative teaching methods for field- and place-based education, such as blended learning or modern playful and multimedia methods. Our students experienced both roles – being students during the field-courses and being teachers during their local activities with upper secondary school students. These activities are presented in this compendium.

We believe that this mix of roles and experience will create an atmosphere where members of the project create knowledge together and experience innovative teaching methods from the perspective of the teacher and the learner.

All the teaching materials that will be created during the project by both teachers as well as students are published online under open licence (creative commons or Open Database License for geodata).

The EduChange Collective (Jiří Pánek, Vít Pászto, Tomáš Daněk, Jan Ketil Rød, Jardar Cyvin, Kristiane Midtaune, Bouke van Gorp, Tim Favier, Paul Pace, Mark Mifsuf, Martin Musumeci, Jakob Bonnevie Cyvin, Charles Bonello).

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Making knowledge together - addressing climate change through

innovative place based education and blended learning

2017-1-CZ01-KA203-035519

HOW DO CLIMATE CHANGES AFFECT YOUR LOCAL AREA?

ScienceJam Compendium 2019

Authors: *Sara Krafft, Ida Kanutte Risvik and Kristin Langemyhr Samdal*

Co-funded by the
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THEME

Learn about climate change and raise awareness of its effects in the local environment through multimedia educational tools and an outdoor activity.

SUGGESTED AGE

14-16 years

ACTIVITY DURATION

150 minutes

SITE

The sites are in the classroom and the surroundings of the school.

RELATION TO CURRICULUM

Sustainable development is now an interdisciplinary subject in the Norwegian curriculum, so activities about climate change, consequences and solutions is very topical to Norwegian education.

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography

Biology

Digital competence

Social sciences

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

The activity aims to make the students learn about climate changes with both a global and a local perspective.

After the activity the students should be able to:

explain global warming and climate change

Identify some effects of climate changes in their local environment.

Present data in a digital map

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REMOTE PREPARATION

The teacher must have knowledge about climate changes in the local area of the school, and how it will change the environment. The teacher has to be able to talk around climate changes and have definitions and explanations to use.

Prepare or find a story map (or similar data) adapted to the students which they use as a tool to explore and do research themselves.

Have a Survey123 ready for the students to map the effects and solution they can find outside.

PLANNING CONSIDERATIONS

It is hard to know what students between 14 and 16 years know about climate change and the local effects, but most of the information they have is likely from media, their parents and friends. Media is often presenting the most extreme facts, so the students can have misconceptions influenced by this. It's possible to give the students credible sources that will give them the opportunity to base their knowledge on scientific research.

The technological devices have to be tested beforehand to make the activities go more smoothly.

Be generally very clear about what the activities are and what the students are about to do. Make the students aware of what they should look for in the activities and encourage them to be creative. Be aware of misconceptions about differences between climate change and environmental problems, such as plastic in the ocean is not a climate change. It might be useful to explain the differences between them.

Another misconception one must be aware of is the causes to climate changes. The students have probably heard a lot about global warming and other environmental issues that could be mixed together. Many of the students have single words they connect to the theme climate change, but they do not necessarily know the content to those words, and why it is that way. The students have difficulties to explain what they are saying. The teacher needs to challenge them to explain deeper and add content to what they are saying. Most of what they say could be connected to the theme, one just have to dig a little deeper.

RESOURCES REQUIRED

Smartphones and tablets/ laptops, premade storymap, kahoot and survey123, pen and paper.

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OUTLINE OF THE EDUCATIONAL ACTIVITY

The education activity can be divided into three main parts, based on a poster with three columns/phases. The poster contains the three following columns:

1. How does climate change impact Trondheim? What do you know already? (Think by yourselves, talk to your partner and then the rest of the class)

2. How does climate change impact Trondheim? (Storymap and research on internet)

3. Which consequences do you see at your place? (Go outside and find some examples)

Time	Activity	why do this:
30 min	**Introduction (column 1):** Ask the students what they know about climate changes and the effects in their own city. Let the student think by themselves first, then talk to a partner and finally do a sum up with the whole class.	Make the students aware of their precognitions.
10 min	**Storymap:** The students go through the storymap with general information about climate changes. The storymap contains several links to different websites with information they can use to answer the question in the second column on the poster.	The links is a way to support and guide the students.
45 min	**Research (Column 2):** The students use the links from the storymap to answer the question in the second column.	The students need support while they work, and the teacher should be scaffolding to their open inquiry.
10 min	**Break**	
40 min	**Outdoor activity (Column 3):** The students go out and use the application survey123 to take pictures of examples where climate change has an effect on the environmental.	To minimise the distancing the students have to the effects of climate changes and their consequences.
15 min	**Summarize**: To summarize the activity go through the kahoot with the questions below and discuss the students answers consecutively.	

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Themes in the storymap:

Effects of climate change:

- Global warming
- Something is weird about the weather in Trondheim (weather forecast in April 2019)
- Sources for Norwegian climate gas emissions
- Map of distribution of climate gas emissions in the world
- Global warming and its consequences in Trondheim
- Mitigation / adaptation
- Follow up activity

Kahoot for the summary:

1. Do you think global warming is caused by humans and that it leads to climate change?
2. Do you think your everyday life will be influenced by the effects of climate change?
3. Which of these sources contributes the most to Norway's climate gas emissions?
    a. oil extraction
    b. transport
    c. agriculture
    d. waste
4. Who do you think should take responsibility to reduce climate gas emissions?
    a. Us (as consumers)
    b. The authorities
    c. Us and the authorities
    d. Nobody
5. Are you willing to change your habits for a better climate?
6. Do you know what you can do to reduce your climate gas emissions?
7. Have you already done anything to reduce your climate gas emissions?

FOLLOW-UP ACTIVITY

In this lesson the students learn about the local effects of climate change, but not much about what to do to prevent, or at least reduce, these effects. A follow-up activity could therefore be to find out what we can do to reduce these effects and find out who should do that. The students can for example make a role-play where they prepare themselves to take a role as a consumer, a politician, a farmer, a researcher, and so on. Then the students can discuss different measures.
The students could also be assigned a specific theme, for example ocean rising and do a presentation for the class. We think the students learn better when they are exploring the subject themselves and teach others about what they have learned.

BACKGROUND INFORMATION FOR TEACHERS

The teachers have to know about consequences of climate changes in their own community. For example marine soil and quick clay are topical problems in Trondheim and the surrounding area, so that is something we had to know about before this activity.

In addition there are typical subjects such as sea level rising, extreme weather (more droughts in dry season and more precipitation in the wet season), more frequently storms and strong winds, and generally how this affects the local environment.

ADAPTATION

Making a poster is adaptable for every class and every age. All students can write something at each of the columns. Everybody knows something from before, they learn something new, and ideally everybody can discover examples of climate changes outside.

The Story Map has to be adapted outside of Trondheim, but there are plenty of material that still is topical around in Norway, and some other countries.

The Survey123 is adaptable to every student as long as it works on their phone. Every student can take a picture or write a comment or keywords about climate change.

EXTENSIONS

The activity we made presents climate change and its effects in the local environment in a very broad sense. If possible the teacher can add more focus on water management in the specific area. In the example of Trondheim this could be heavy rainfall, quick clay, surface runoff, storm surge and sea level rise.

REFERENCES

The storymap we prepared for the students includes an introduction to global warming and local effects of climate changes in a very broad sense. The students are supposed to research the local effects themselves, but we added some links to relevant resources:
https://ntnu-gis.maps.arcgis.com/apps/Cascade/index.html?appid=13bf4e6ff9da49a3ac4e628636b63767

Survey123 is a field data gathering solution which we used as a tool to make the students log effects of climate change in the local environment of the school:
https://arcg.is/0rXnub

The kahoot was meant to sum up the activity and functioned as a reflection of what they had learned, after each question we discussed the answers and added more information if necessary:
https://create.kahoot.it/details/517c0812-71d1-4240-a3df-edf09905449a

ACKNOWLEDGEMENT

Thanks to Steinerskolen at Rotvoll that let us try out our activity.

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SIMULATION GAME

ScienceJam Compendium 2019

Authors: *Zuzana Daubnerová, Adam Kolář, Kateřina Křížová*

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THEME

Climate change

SUGGESTED AGE

15 – 19 years

ACTIVITY DURATION

90 min (135 min)

SITE

Conference room if available

Classroom – shall be adjust to the round table

RELATION TO CURRICULUM

Civics (Politics, international relationships)

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography (Political geography, Physical geography)

Ecology (education to sustainability)

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

Students will be able to explain the concept of climate change, its causes and impacts and interconnections.

Students will be able to list various consequences of climate change in different countries.

Students will actively experience simulation of multinational meeting and they will discover how it may work in reality.

Student will be able to describe environmental issues connected to climate change in their country/region.

Students will enhance their social, communication and negotiations skills, critical thinking and decision making.

REMOTE PREPARATION

Teacher might introduce the topic of climate change prior to the proposed activity, so students are familiar with it in more depth.

Teacher shall prepare various examples of the impact of climate change from their country/region.

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PLANNING CONSIDERATIONS

It is important to include debriefing part and reflection after the role play so students can express their feelings, positive or negative emotions.

It is necessary to coordinate the meeting and if it gets too emotional it is better to stop the simulation.

RESOURCES REQUIRED

Political map

Map of your own country/region (possibly online)

Data projector, internet connection

Video about climate change

Cards with roles (states) and its description

OUTLINE OF THE EDUCATIONAL ACTIVITY

Introduction

Mind Map

In the beginning, students´ task is to create individually a mind map focused on the topic of climate change. They are supposed to write anything they know about it as well as the things they are not sure about and they would like to learn more about. They keep their papers and use them again at the end of the lecture as an assessment tool when they will make a map once again and compare it with the first one. This will allow them to realize their learning progress. Lecturer asks some of the students to share the thoughts they have written in the mind map.

Subsequently, a video about climate change is screened. It will provide basic information about the phenomenon (including definition, causes, impacts and solutions) which will enable students to understand the topic more deeply and also to use information as arguments in simulation game. It would also be beneficiary to explain what the Paris Agreement is because it will be used in further discussion.

Note: In case that teacher works with the class in the long run, it is advisable to spend sufficient amount of time on the topic of climate change prior to the proposed activity, so students have a really strong base of the issue.

Proposed videos:

- https://youtu.be/Sv7OHfpIRfU
- https://youtu.be/EtW2rrLHs08

Development

Simulation Game

After the introduction dedicated to climate change, students will participate in the simulated international negotiation meeting where they will discuss climate change and its possible solutions. Students are divided into the small groups (preferably 3-4 people, depending on the number of students) and they are supposed to represent a certain state in the negotiation. They will receive a short summary describing a state and the problems they face. If needed, they may search for more information on the internet. Students´ task is to come up with strategy for negotiation process and, depending on their assignment, either try to fight for a change or remain in the current situation. The goal of the game is to show to students the complexity of the problem, how difficult and time consuming it is to negotiate on the international level about climate change. Moreover, it aims to provide scholars with more information on the various impacts of climate change that are different for each country. Every country in the world is connected with climate change, either as a producer of emissions or its "victim". Therefore, climate change is global as well as local issue and it is important to discuss it.

It is recommended for the teacher to make notes during the simulation as he/she can use it in the reflection.

Materials needed for the simulation game:

Introduction to the international panel discussion:

"Let me welcome you in this international panel for climate. Your task for today is to discuss climate change and its impact on the whole world. In the end, you shall come up with some proposal to change the current system and solution how to tackle this issue. You will be given short time to think through your position and strategy which will be followed with an official negotiation meeting led by a teacher/lecturer."

Actors:

China

You are representing the most populated state in the world: China. This country is the biggest producer of carbon dioxide emissions in the globe which accounts for 30% of the world's emissions. The worst problem is coal mining and other fossil fuels. Its industrial procession in factories causes pollution of air, water as well as soil. However, China needs its factories so it can prosper and compete with other world powers such as the European Union or the United states. Its intention in today's meeting is to come out without any radical change that could potentially threaten its industry. China is not willing to invest into green solutions and requires developed countries of Europe to change their behaviour.

Bhutan

You are representing Asian state Bhutan. This country cares very much about the environment and its protection which is implemented even in their constitution. Bhutan emits minimal amount of emissions that's why it requires limitation from other states. Air and oxygen is shared by the whole planet so it is important that everybody is participating. Moreover, it is a country located in the Himalayas - the world's highest mountain range also known as Third pole because of its never melting ice and snow cap. Unfortunately, in recent years it has started to melt due to climate change and global warming. As a result, other problems are more common, for example: flooding, landslides or insufficient amount of drinking water. As one of the least economically developed countries you have only limited amount of finances to deal with it. Since Bhutan is a small state it needs to cooperate with actors that have stronger negotiation position. On the contrary, China is your biggest enemy.

Brazil

Until the last year you were one of the most significant players in restricting greenhouse gas emissions, limiting deforestation and you were proud for development of renewable energy sources. At the end of 2018, Bolsonaro - an extremely right-wing president was elected. Direction of Brazil has turned by 180° since then. In your opinion, protection of environment is in contradiction with economic development and at the same time, the protection of other states should not threaten the economic progress of Brazil. Due to the fact that Bolsonaro has opened Amazonian tropical forest to international developers, intense wood logging, worsening of global warming and deepening of climate crisis are a result. On the other side, Brazil has now more financial means in its state budget which can be used to eradication of poverty, improvement of education or decrease of high unemployment. You are content with the current situation, you do not desire any change and need a lot of money.

Inuits - Labrador, Canada

You are representing a community of Inuits living in the Northern pole. Your life is directly dependent on the ice and snow cap cover and hunting of wild animals such as birds or fish. However, climate change and global warming are causing global ice melting. The area of ocean covered by icebergs in Northern pole decreased by 10 % in the past few years and thickness of ice above the sea water decreased by approximately 40 %. The surface of icebergs in your area is smaller by one third than it used to be ten years ago. Decline of ice and weather fluctuations mean that you need to adapt to new conditions and leave your traditional way of living since the places where you used to hunt are not accessible anymore. Your region is one of the most warming places in the world. More and more often, you are becoming dependent on the import of processed food which has a negative impact on your health. It is likely that in the future you will have to move out and migrate to other places. It is in your interest to convince other states to reduce their greenhouse gas emissions in order to stop further global warming of our planet.

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Maldives

You are the inhabitants of island state Maldives, the flattest state in the world, located in Indian ocean. The peak of Maldives looms to altitude of 2.4 m. The capital Male is surrounded by 3m tall wall. The majority of inhabitants lives by the seashore so the elevation of water level would make them move to higher sites of the island. It is known that there is a high chance of occurence of so called environmental migrants trying to reach near India or Sri Lanka. Maldives are known for wide-ranging biodiversity, especially in the area of coral reefs. Most of the people work in fishing and tourism. Maldives are one of the world most endangered countries due to elevation of seawater level caused by the climate change. The scientists estimate that if next year there is the same amount of deflated CO2 as this year, in seven years Maldives will be completely drown under water which means the very disappearance of the whole state. Rising temperatures and fugitive emissions of CO2 cause a lack of biodiversity by the coral reefs that affects tourism - people have no reason to go scuba diving, and for fishing industry the lack of fish means lower profit. Also, the climate change brings to Maldives even more intense tropical storms every time they hit the island. It is in your interest to convince other states to reduce greenhouse gas emissions in order to stop worsening of the climate change that has huge impact on your existence.

USA

You are representing the United States of America, one of the most influential and the wealthiest economies in the world. In absolute numbers, you are the biggest donor of foreign development aid, however, your policy is mostly focused on your profit. You are aware of dangers that would be caused by climate change but you refuse to cut the production of emissions because if you do so you will generate less profit in short-term future and other economies could take the lead. Thanks to withdrawal from the Paris Agreement the USA canceled the pledge to reduce CO2 emissions and since that emissions produced in your country have been slowly rising because there are no restrictions. Thanks to that, your economy could grow easier because you don't have to care about the environment so much. You will keep polluting planet until all other countries change policies to be more environmentally friendly so everyone would have the same restrictions. Your main interest is your economy and your wellbeing and also "to make America great again!"

Democratic republic of Congo

You are citizens of the second biggest country in Africa - Democratic Republic of Congo. Your state is situated in the centre of Africa and big part of your territory is covered by tropical forests which are being cut down because of agriculture production and extraction of raw materials. Democratic Republic of Congo lays on equator, and thus, the average temperatures are around 25°C. Decrease of rainfall in agriculture areas caused by rising temperatures will lead to the reduction of harvest and insufficient adaptability of farmers to changing weather conditions will cause further problems. You are relatively poor state and changing climate may influence agriculture production which is crucial for

your economy and livelihood. Furthermore, rising temperatures and increased humidity on the life cycle and habitat of mosquitoes carrying malaria may increase malarial zones and so the number of victims. Therefore, it is very important for you to fight climate change and come up with solutions to adapt to these problems.

Germany

You are the leaders of an advanced European state with a very strong economy. At the same time, you produce the most CO2 emissions in the European Union. Climate change will cause sea level rise, which will result in flooding of western part and extreme droughts in eastern part of Germany. You acknowledge these facts and therefore do everything possible to achieve the Paris Agreement objectives so you avoid climate change consequences. Like many other countries you have developed your own action plan to reduce emissions by 55% by 2030. Germany produces 40% of its energy from renewable sources, such as wind, water or solar radiation, with a target of 65% by 2030. Your aim is to continue to reduce pollution in order to achieve or exceed your goals in the Action Plan. You care to set a good example to other states.

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CONCLUSION

Reflection of the simulation game

After the simulation game, it is really important to reflect the feelings students experienced during the negotiations. Teacher should give them space for expression of negative as well as positive feelings. The teacher can use the following questions:

● How was the game for you? Students make a scale in the class, one end of the class is for good feelings and another end for bad feelings, the middle is neutral. Teacher asks students why they feel how they feel - he/she asks both sides.

● Did you like your role/the role of the state you represented? And why? Teacher can again use the scale for assessing this question.

● During the game, did any difficult/crisis situation occur? Teacher can use any yes/no method (scale, raising hands, etc.) for finding out. If there was any situation like this, the teacher should discuss it with the students. Why it happened, what was the process of the “conflict” and how it ended up.

Next step is to reflect the simulation game itself. Here is a list of questions for reflection teacher can use.

● Was it easy to negotiate about climate change? If not, why was it so? In real world, negotiations on international level aren't normally easy and they could take days or years to come up with some solutions on given problem. States which are present during the negotiations have different backgrounds, problems, international politics and in our case also different approaches towards climate change. After the common conclusion, parties sign international agreement but the document may not be legally binding.

● If you had the chance, would you like to change your role in the game and why? In the simulation there are “the bad guys” and “the good guys”, some students might want to change their role.

● Did anyone have a better position in the negotiations and why? The rich countries didn't want any change and they have better position because they are developed and most of the times bigger than developing countries, at least economically. Meanwhile, small states which are endangered the most have lesser power in the negotiations and it's more difficult to pursue the change they want.

After answering the questions above, the teacher should give a short sum up which countries were in the game and why they were picked for the game. Another summarization should be done with the consequences of climate change. It is important to note that climate change is a complex problem and the selection of the states is just to get a picture about various impacts of climate change in the world. At the same time, developing countries are not only victims of climate change since some of them contribute to emissions and pollution in great extent, tool.

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Local environment

Provided that the teacher has more time with the students, he/she can focus on the local environment of their country or region. He/she can discuss thoroughly the impacts of climate change in their country, the biggest problem there and if there is any solution. Teacher can start the discussion with a question: Have you noticed some changes in recent years in your surroundings which could be the result of climate change or which could lead to worsening the phenomenon?

What we can do?

It is important to give students opportunity to act, it may happen that students got frustrated about all the harm we humans make to our planet. Students need something they can do by themselves. Teacher can speak about bigger actions as Fridays for future or little acts they can do at home on individual level. How to reduce waste or stop wasting valuable resources such as water. You can also see section about follow-up activities.

Reflection of the whole activity

Teacher asks students to draw a mind map about climate change similar to the one they did at the beginning of the lecture. After they are finished, students will compare these two maps; in this way, they can see their learning progress and gained knowledge. If desirable, the teacher may use this tool as a feedback by asking students to hand in the maps with the same number assigned to each of them.

FOLLOW-UP ACTIVITY

Action: students can come up with some activity in order to help the environment - clean up around the school grounds, new recycling stations in the school, etc.

Field work: teacher can create a field work into the nature to research local impacts of climate change. Students can observe and make notes.

Awareness raising campaign: after the class students can organize awareness campaign about climate change for their younger peers or local community.

BACKGROUND INFORMATION FOR TEACHERS

Global climate change NASA: https://climate.nasa.gov/

What is the Paris Agreement: https://unfccc.int/process-and-meetings/the-paris-agreement/what-is-the-paris-agreement

Fridays for Future: https://www.youtube.com/watch?v=oJ_QkjieLmw

What you can do about climate change: https://www.youtube.com/watch?v=VTfgNFz1DBM&t=170s

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ADAPTATION

Students with learning difficulties or students who are not willing to participate in debates or group work could have a special role in the game. The role is the observer of the meeting and negotiations. He/she may write down notes about what happened during the simulation game. Afterwards the teacher can use this information for reflection of the game. Another adaptation is that he/she will write an essay about what he/she would do differently in the game.

EXTENSIONS

After the end of the class, gifted students can write an article about the simulation game and publish it in the school magazine.

They could create a poster about another country which is affected by climate change and present it during the next class to others.

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WASTE AROUND US

ScienceJam Compendium 2019

Authors: *Petra Ďuriančíková, Eliška Záhorová*

Co-funded by the
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THEME

Waste around us.

SUGGESTED AGE

15-19 years (high school students)

ACTIVITY DURATION

90 minutes in class (45 introduction + 45 conclusion), 30-60 minutes data collection as homework.

SITE

Introduction and conclusion in class

Fieldwork done in an area picked by the student groups, where they live or spend their time

RELATION TO CURRICULUM

Environmental science - waste and recycling

Social science - waste and recycling

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography

Informatics

Social studies

Mathematics

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EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

Overcoming psychological distancing by collecting data in the students' surroundings.
Analyze the distribution of litter and bins in your area using the map created.
Discuss what you remembered, what shocked, interested and surprised you.
Discuss at least three measures you take to prevent creating waste and what you do with waste at home.
Raise awareness about measures for reducing waste by introducing topics such as zero waste lifestyle and veganism to the students.
Discuss what should be changed in our behaviour, both locally and globally.

REMOTE PREPARATION

Prerequisite knowledge – types of waste and waste containers, waste sorting, recycling

Preparatory task - data collection

PLANNING CONSIDERATIONS

Know your students - is there anyone with a physical handicap or learning disability? Adapt the activity, if needed and pick the teams accordingly. Teams should be based on the area the students are from and on the level of their knowledge, skills and their behaviour.

Teacher should write down names of students in each team – this should prevent the students from avoiding the task and will help keep track of the teams. It may happen that the students will forget their team name.

It should be properly explained that nobody needs to sign into ArcGIS during this task (students should just download the app and then go to the links used for the surveys in their web browser)

Make sure that students have access to the internet to download the app, so that they don't have to use their data

RESOURCES REQUIRED

At least 1-2 smart-phones per group
Internet connection for downloading the application and surveys and uploading the collected data

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OUTLINE OF THE EDUCATIONAL ACTIVITY

Introduction

This activity uses mobile technology to map waste containers, bins and waste in an area picked by the students. The technology used in this case is the application Survey123. The goal is to overcome psychological distancing surrounding waste and consumption, by having the students map a location themselves and then connect the data they collected with the information provided by the teacher in a presentation. Discussion is welcome and essential to get the best results.

Teacher will introduce the theme and the application used in the form of presentation approximately 15 minutes long. Recommended problems to be included in the introduction to the theme are: local statistics about waste in your country (how much plastic is created, recycled, burned etc.), what are the main local problems with waste, microplastics, the great garbage patch, plastic pollution, Clean up the world project. Recommended information to be included in the introduction to the application is: how the application works, where to download it from, how to download surveys, questions in surveys, screenshots of data collection.

Students will then be asked to form groups of 3-5 people. Teachers should motivate their students by setting a competition between the groups, i.e. most creative photograph or most mapped locations.

Afterwards the teacher should practically try out the app with their students in the classroom or outside. Students can map bins or garbage in the school or on the school grounds. It is essential that students understand how to use the application and the teacher should answer all questions clearly. If this is done in the classroom, location in the app would not work accurately, as the mobile navigation does not work well indoors.

Development

Students will map garbage and containers outdoors in their free time with Survey123. The area of mapping is optional. It is recommended that it will be an area where they live or spend their free time, so that they feel directly connected to the data they collect.

For mapping of garbage, they would be using a survey called “Garbage”. There are options for types of garbage, description of garbage (i.e. a plastic fork, a can..), photo and location.

For mapping of containers, they would be using a survey called “Bins and containers”. There are options for types of containers, fullness, condition, photo and location.

In both surveys they have to fill in the name of the group they are part of. At least 20 mapped locations are recommended per group, so that there is enough data and broad area is covered.

Conclusion

Teacher will arrange a discussion with students based on the map made from the data they collected. It could be a story map, interactive online application or a static map. Survey123 allows the creator of the survey to create a web map directly from the collected data. Then the map can be transformed to a story map or an online application.

Students will analyze the amount and distribution of garbage and containers, most found types of garbage and containers and the likely reasons for this using the map. Students will discuss what has surprised them the most during their data collection.

As it is important to present some solutions, the teacher will present measures students can take to reduce their waste, e.g. zero waste lifestyle, slow fashion, reusable and eco-friendly alternatives for every-day use (metal or glass water bottle, metal straw, reusable bag, bamboo toothbrush). Students should discuss what have they remembered from the whole experience and what measures they would take/are considering to take in the future.

At the end of the lesson students' competition should be concluded by awarding the most successful groups.

FOLLOW-UP ACTIVITY

Group project (essay/poster/presentation) all very short.

Evaluation of the activity by students in the form of survey.

BACKGROUND INFORMATION FOR TEACHERS

Survey123: https://survey123.arcgis.com/

ArcGIS online: http://www.arcgis.com/index.html

If available, use a local map of waste bins, we used a map of Olomouc: http://www.olomouctridi.cz/odpad

Interactive map used in our lesson: https://tinyurl.com/mapa-kose

If available, use a local blog about zero waste, we used a Czech one: https://www.czechzerowaste.cz/

Plastic Ocean document: https://www.youtube.com/watch?v=6zrn4-FfbXw

Some information about sustainability and measures you can take to minimize waste: https://tinyurl.com/ways-to-reduce-waste

https://tinyurl.com/37-ways-to-reduce-waste

Consider talking about menstruation, if appropriate (in our case, it was not possible), introduce menstrual cups to the students, a great alternative to sanitary towels and tampons: https://tinyurl.com/introducing-menstrual-cups

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ADAPTATION

Student groups work in their own pace and to their best ability, groups can be modified to include everyone and to help students with learning disabilities

Using the application is quite simple, all the students have to do is choose options in the survey. The groups should be built to accommodate everyone and so that the students can help each other.

Adaptation for students with physical handicap/injury: homework can be missed due to a serious handicap/injury that wouldn't allow the student to participate, activities in class are inclusive

EXTENSIONS

If the students enjoyed this activity and would like to carry on, they can map different locations to learn more about their surroundings.

With the teachers help, the students can make their own survey to map anything they would like

It is recommended to watch documentaries or informational videos regarding the issue of waste, such as Plastic Ocean

After school club/activity – spread the message

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APPENDIX

Pic. 1: Working with the application Survey123

Pic. 2: Trying out of the data collection indoors

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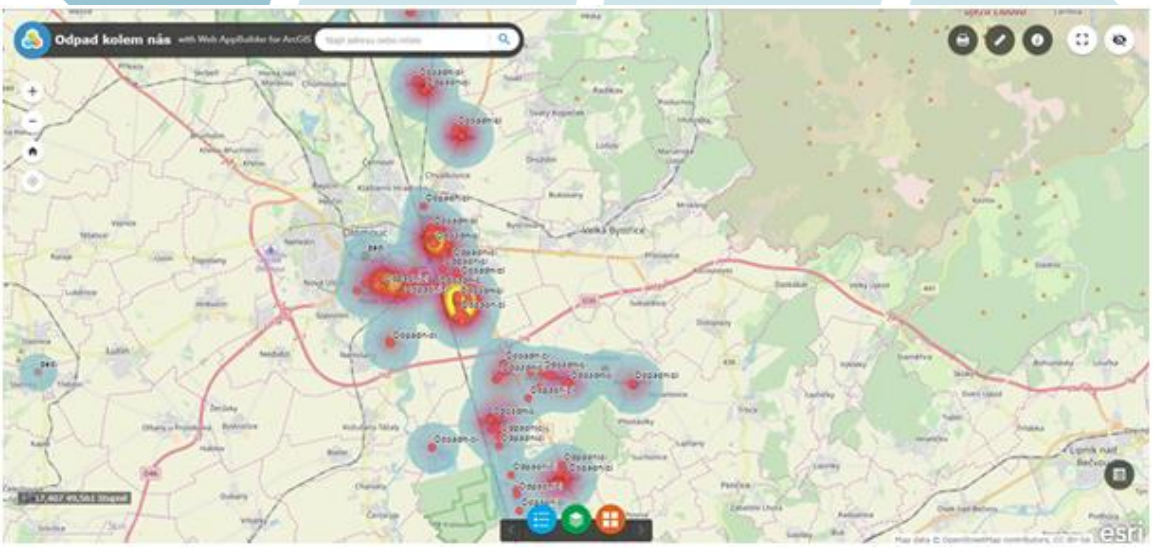
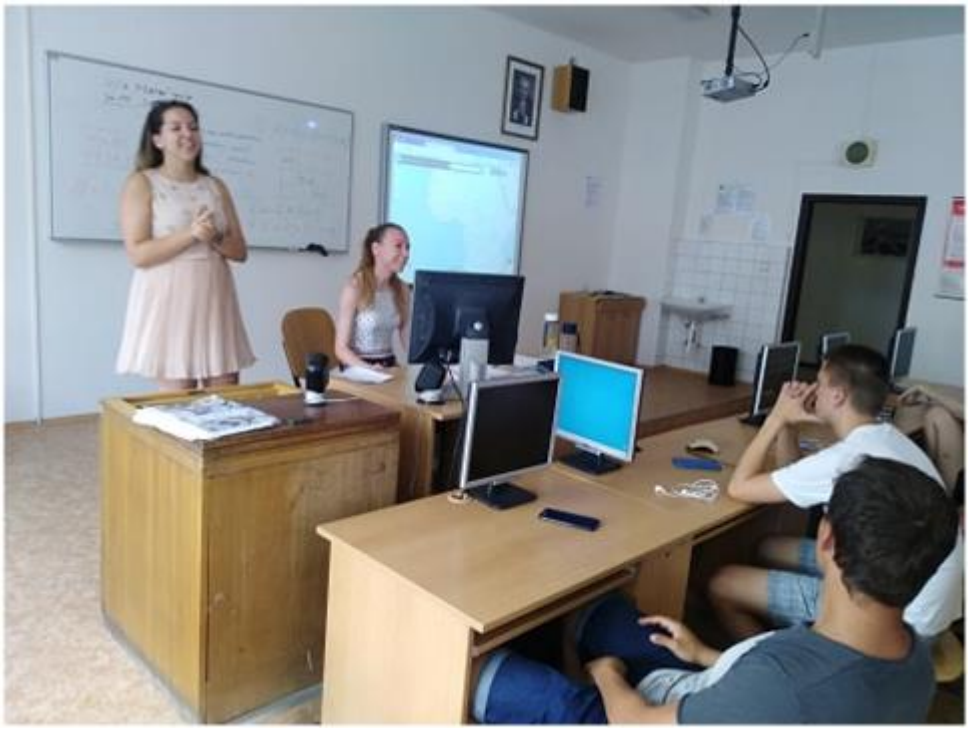


Pic. 3: Web application created from collected data



Pic. 4: Conclusion lesson with students

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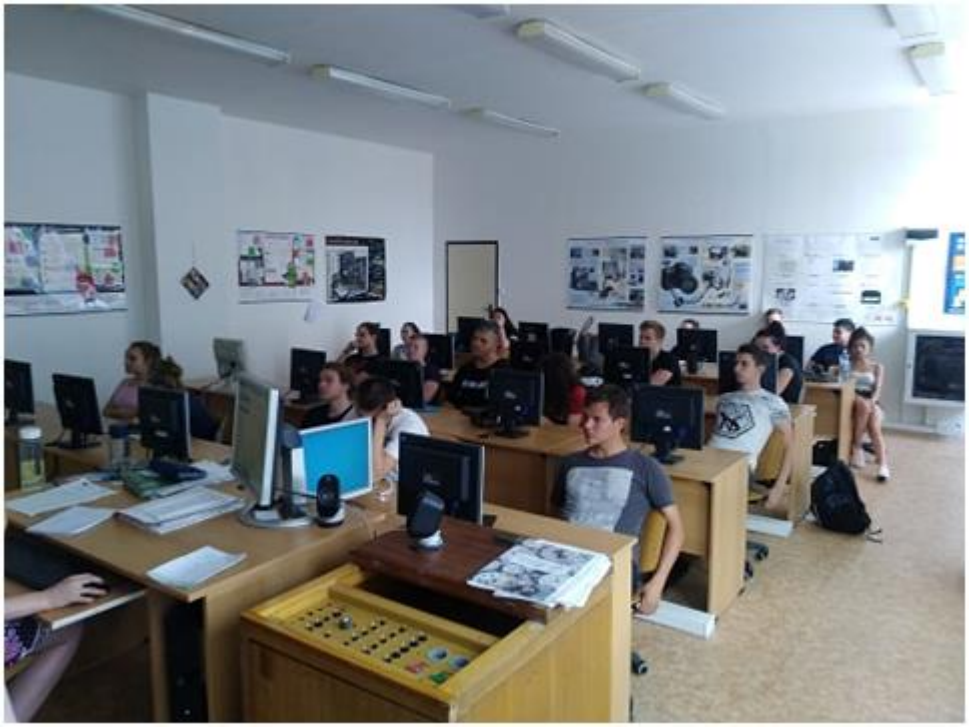

Pic. 5: Conclusion lesson with students

Making knowledge together - addressing climate change through

innovative place based education and blended learning

2017-1-CZ01-KA203-035519

CLIMATE CHANGE - WE NEED TO ACT NOW

ScienceJam Compendium 2019

Authors: *Jan Borkovec, Karolína Formánková*

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THEME

Climate change and alternative solutions for decreasing causes based on personal daily decisions

SUGGESTED AGE

15-18 years

ACTIVITY DURATION

3 x 45 minutes

SITE

Indoor and also outdoor activity

RELATION TO CURRICULUM

Every subject as it includes everything, for example recommended subjects are geography, social science or block of lessons focused on climate change.

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Topics as water science, climate and weather, global trade and geography, atmosphere.

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

Students will get familiar with complexity of problem of climate change, students will find out their own ecological footprint, students deepen their knowledge about alternative ways of living, students will more appreciate trees and their major importance for nature, students get familiar with international solutions for greenhouse gases, students practice their negotiation skills.

REMOTE PREPARATION

It is recommended that students will receive the email with internet sources and movies which they can watch before class(block of lesson so everybody now the topic. Teacher can send them what he finds important or use the sources what we have at the end of this document. It is also highly recommended that students will sit in circle during activities.

PLANNING CONSIDERATIONS

If students will be tired it is good to stop indoor activity and take them outside for outdoor activity and them keep going inside.

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RESOURCES REQUIRED

Paper, possibility to go outside, internet, mobile phones, projector.

OUTLINE OF THE EDUCATIONAL ACTIVITY

The presented study plan is based on the E-U-R educational teaching method which is sometimes also called a three-phase model of learning. Its focus lies in the idea of respecting mechanisms of natural process of learning-discovery. The model is comprised of three learning phases:

- evocation: aims to motivate and activate students´ interest in the theme; teacher helps students to realize what they already know about the topic, what they think about it
- awareness: importance of information: learning phase; students are exposed to, process and fixate new information through relating it to their previous knowledge
- reflection: students systematize and formulate new knowledge by realizing what they have learnt during the lesson (they will clarify what they know about the topic now, what they are unsure about, what they would like to learn, how they can use this knowledge in their daily lives/in the future, etc.)

Evocation:

Students will start with brainstorming activity about climate change. Students will write associations what they have with this topic. The theme the first line is our teaching theme –global climate change. Teacher can the six lines draw on the board so students will have it on their eyes even during their own task. Depending on the number of students, they can work alone and at the end teacher will call few individuals who will tell everyone aloud what they have written.

Or they can play game that one will write answer for the first question and then fold the paper with the answer and then pass it to another one, at the end everyone will read the whle paper what will end in their hands.

What? Theme – Climate change (2 words)

What is it? Description of the topic (2-3 words)

What does it cause? – (1-3 words)

Solutions? – (1 – 3 words)

The sentence - 4 word sentence (essential sentence about climate change for them, it can be for example slogan for demonstration)

What? _____ _____

What is it? _____ _____ _____

What does it do? _____ _____ _____

Solutions? _____ _____ _____

The sentence _____ _____ _____ _____

After the game teacher will include missing information from game:

Sources of pollution (caused by humans) which should be mentioned: factories, car exhaust gases, power plants, wastes, cattle ranching, deforestation. In attached presentation are pictures also teacher will show students advertise on snickers https://www.youtube.com/watch?v=B2hRFi0kjM4 followed by a video showing the state of forests due to palm oil production and after will start disscusion.

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

(Indonesia where about 85 percent of the world's palm oil production is produced) and what happens to the orangutans who lived here before. There is a debate about whether, despite all this, advertising is catchy, there are alternatives to palm oil, or what and what can we do? Buy only products without palm oil, write to companies that we want to buy their products, but without palm oil (Cornybig is palm oil free). Why is palm oil the most common?

Mainly because it is the cheapest one.

Solution which should be mentioned:

Transition to renewable energy, Afforestation, Reduction of meat consumption, Reduction of car and air transport by individuals and by corporations, zero waste.

Also teacher will mention concept of Natural garden – Teacher asks students, Do You really need english grass? Do You like it, one same colour of green, any diferent? Teacher conducts discussion about adventage and disadventage about natural garden.

We write the advantages and disadvantages on the board and then discuss them. Plus question - how many times a year do you mow the grass? Why?

Advantages:

- promote species diversity,
- keep or even improve the quality of the garden in the garden
- get involved in protecting the habitat of useful animals,
- you grow your crops full of vitamins, which will not contain any foreign substances,
- you will be delighted to do things meaningfully
- maintenance of such a garden (if it is well established) is not time consuming,

- you can support old county varieties that have their place here,
- Effectively use all the materials or materials created in the garden – from grass to fallen leaves or branches
- By using waste efficiently, you can try waste-free management, which is now supported by many supporters.

Source: https://homebydleni.cz/zahrada/realizace-zahrad/proc-si-zalozit-prirodni-zahradu/

Impact:

Melting of glaciers, increase of average temperature of the planet earth, more frequent floods,rise of sea level.

http://news.bbc.co.uk/2/hi/8311838.stm (Maldives has held a cabinet meeting underwater to highlight the threat of global warming to the low-lying Indian Ocean nation)

Awareness on individual solutions:

In order to avoid psychological distancing teacher will through basic activities demonstrate students how also their behavior is influencing climate change:

- Students will try to guess how many apples are every year imported to their country? The information can be found for example in national fruit union. Source for Czech republic: https://www.ceskenoviny.cz/zpravy/dovoz-jablek-loni-nejnizsi-za-10-let-dovoz-z-polska-i-tak-rostl/1709581

Teacher can invite them to go and write their ideas on the board or let them stand in imaginary line from 0 to 100 000 ton depend on what is their guess. Teacher will tell them right answer (in case of Czech Republic the number is 78 000 imported ton of apples for last year) and then they discuss why it is bad for environment and if they can support better conditions differently then buy local apples.

- Students will try to count how much water they use per day der. Information can be found on Statistical office. Teacher will tell them average water consumption in their country (in case of Czech Republic the average Czech uses 89 liters per day) and then they discuss why it is bad for environment and how they can reduce their personal consumption (trapping rainwater, use water again- concept of gray water)
- Students will try to count how much virtual water they use daily - teacher will let them use their mobile phones and recommend some website where they can find information about how much water different crop consumes before it gets to them. If it is needed teacher can explain the term of virtual water, but preferably let students to find it by themselves. After results teacher will ask them how they think they could reduce it and etc. (https://www.watercalculator.org/water-use/)

- Discussion about washing machines - students should divide between two groups based on their assumption what is more ecological, is it washing your dishes in hand or use washing machine?

In our case the discussion took around 20 minutes – As first we gave some time to both groups to prepare three main arguments which support their claim. After both group heard arguments of the opposite side they got around 10 minutes during which the\ could use their phones and look up some facts which would support their claim. Students during this found out that some website were claiming things which was other website denied, they got in contact with critical thinking and with our help they got to the final statement that it really depends on the situation (kind of washing machine, amount of dishes, how much water we use when we wash by hands is individual etc.)

Game Oh, our land

As we are aware that tree has has great importance to man and environment. We planted our own planting trees with students. We really recommend it for schools, if they own the land around school to demonstrate one of the best solutions to climate change in practice. Even if the school does not own the property we recommend to get in touch with local municipality and ask them for some land where students could realize appropriate afforestation for local conditions.

We unfortunately have not yet enough time to realize the planting trees. Instead of that we choose outside game with students which emphasize the importance of the tree.

Description of the game:

The game simulates the soil-protected effect of trees on the slopes. Most of the students present trees, less (one third) erosion. Each tree with its roots retains soil against water and wind erosion. In the game, the soil is simulated with sheets of paper or trees. Around each tree (the player representing the tree), 10 units of land are deployed to hold the tree roots (10 leaves). The remaining players representing erosion, whose goal is to carry the soil away from the trees, if there are only 3 or less soil units in the tree, the tree will dry and become erosion. The task of trees is to survive. Erosion can be taken one sheet at a time and must always be taken to a predetermined place (to the teacher) where the player representing the erosion also comes to revive if the tree slapped the hand to revive it cannot collect leaves. At the beginning of the game, the trees can be distributed regularly (trees simulations that are being planted by humans) or distributed irregularly (simulation of natural forest regeneration). The game can be ended after a period of 30 minutes / by cutting down several or all trees. There is a debate about where and why erosion took better ground (they should be extreme trees) Why is that?

Awareness on international solutions

Unfortunately we did not have the time to realize this activity, anyway we have prepared to emphasizethe fact that greenhouse gas production has an impact on the whole atmosphere and hence on all countries of the world, the states work together and agreed on the rules they will have to follow. Greenhouse gas emission allowances are one of the tools for limiting the carbon dioxide production that states have set.

Greenhouse effect: In case that students do not know it, teacher can show them short video: From 1.20 to 3.20 (https://www.youtube.com/watch?v=SINd2axjisU&t=214s)

Teacher will start with short introduction:

It's been thirteen years since the famous Kyoto Protocol came into effect This is an international treaty that has pledged industrialized countries to reduce their emissions to gas by 5.2%. To experience how the greenhouse gas emission allowances are working we will play little game.

Rules:

- Teacher maintain that each country has a certain amount of tons of carbon dioxide that it can produce per year.
- Each country will then divide this amount among its factories and power stations. If a given factory or power station does not consume so much, the excess quantity can be sold to others that do not manage to meet the limit that has been assigned to it.
- A factory that doesn't handle the limit and needs more tons of carbon dioxide has two options. The first possibility is that he can buy the necessary tons from the factory (or more factories) that did not use the amount allocated to it. The other option is to invest in a factory in a poor country and help it reduce its emissions. It can increase its emissions of this factory in a poor country.

Students are divided into 5 groups. Each group represents 1 factory located in the Czech Republic. The teacher will represent the factory in a poor country.

In the beginning, it is said that the Czech Republic has been allocated 100 tons of carbon dioxide, which it has divided among these 5 factories. Each group receives paper with the amount of carbon dioxide produced per year and how much it has been allocated. Each group must then calculate whether it needs some extra tons or whether it has some tons of it. If the tons allocated to it are inadequate, they need to buy the amount they need from another factory that has tons or may decide to go to a factory in a poor country (a teacher) to help them reduce its emissions by as many tons as it needs. Activity ends when all factories have a sufficient amount of tons allowed.

Tons produced and allocated for each group:

Produces 30 tons. Assigned 20. Status = -10.

Produces 40 tons. Assigned 20. Status = -20.

Produces 25 tons. Assigned 20. Status = -5.

Produces 15 tons. Assigned 20. Status = +5.

Produces 5 tons. Assigned 20. Status = +15.

Some students have to go to a factory in a poor country and invest in it to make it clear that this possibility also exists in practice. After the game they reflect what they think about efficiency of this system for global environment

Reflexion:

In this activity students will be divided in groups per 4. They will get the task create their own climate change game – called HEAVEN HELL PARADISE – they have to find the right answer to these following questions, they can use their phones or book ect. It is up to them how they will divide roles (design, correct answers)?

Link how to create Heaven hell paradise game: https://www.youtube.com/watch?v=HnvTKzE0K98

Questions:

What is the solution to water retention in soil?

How much real water does a person consume a day on average?

What living organism absorbs CO2?

What transportation has the biggest carbon footprint?

What transportation has the smallest carbon footprint?

What year is the ban on disposable plastic in the EU?

What state had a meeting underwater for climate change?

How much virtual water does an average person consume daily?

How many people are likely to put climate change into motion by 2050?

Name of teenager climate activist?

When they are done and they have 4 games they will find someone else from different group and play the game with them. It is recommended that students will take the game home with them and play the game with their family.

Conclusion: Teacher will ask students to write on paper what surprise them from today´s lesson (nothing is also allowed answer). What from the suggested individual solutions are they already doing? What new alternative solution would they like to include into their life? What did they like most from the activities?

FOLLOW-UP ACTIVITY

Plant around 30 trees with students.

BACKGROUND INFORMATION FOR TEACHERS

http://www.unwater.org/water-facts/climate-change/

https://www.carbonmap.org/

https://www.globalforestwatch.org/map

https://www.carbonfootprint.com/calculator1.html

https://www.footprintcalculator.org/

Movies:

https://www.youtube.com/watch?v=jqxENMKaeCU (Home)

https://www.youtube.com/watch?v=0m6iqkZOT64 (Plastic ocean)

Climate change – The Facts (2019)

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Making knowledge together - addressing climate change through

innovative place based education and blended learning

2017-1-CZ01-KA203-035519

CLIMATE CHANGE AND WATER

ScienceJam Compendium 2019

Authors: *Kirsten d'Amato Degabrielle*

Co-funded by the
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of the European Union

THEME

The effect of global warming on climate change and solutions to mitigate global warming and its effect (Climate change).

KEYWORDS

Climate change, flooding, heat.

SUGGESTED AGE

8 – 9 years old

ACTIVITY DURATION

4 activities. Total time – 2 hours.

SITE

On school premises.

RESOURCES REQUIRED

Online video,

Tablet,

Map of Malta,

Power Point presentation,

Flask, small toys, containers, water and ice.

CONNECTIONS TO OTHER SUBJECTS

Science (Primary)

Social studies (Geography section -Primary)

English language

EDUCATIONAL OBJECTIVES & LEARNING OUTCOMES

Education Objectives

- Enhance skills such as problem solving skills and critical thinking skills,
- Strengthen their skills to work in groups,
- Linking activities to possible real life scenarios,
- Integrating technology to create possible solutions to mitigate climate change,

• Cross curricular teaching.

Learning Outcomes

This activity will help students to:

• Define the term 'climate change',

• Learn that global warming is causing climate change,

• Use a map to identify what happens to towns and cities which are near the sea if there is a rise in the sea level.

• Recognise what happens to sea water level if climate change persists,

• Experience what happens in case of rising sea level by doing an experiment,

• Find solutions to mitigate climate change.

PREPARATION FOR TEACHERS

Teachers should be able well informed about climate change, global warming and sea rising levels and how these three terms are linked to each other.

Teachers need to prepare the necessary resources needed for all the lesson.

PREPARATION FOR STUDENTS

Prior this lesson students should make sure that their tablets are fully charged.

Bring small toys to construct a town near the sea.

Background knowledge of the Maltese map.

OUTLINE OF THE EDUCATIONAL ACTIVITY

Introduction:

The children will be asked to define the term climate change. Afterwards, the children will watch a video on climate change: https://www.youtube.com/watch?v=Sv7OHfpIRfU.

Step 1:

The children will then be asked about what they think will happen to water if climate change persists. The children will be asked to note on their tablet what is happening in Malta right now.

Step 2:

The teacher will show the children a power point and they need to work out the exercises on the ppt.

Step 3:

The children will then construct a town near the sea. The children will then place the small toys and the containers to build this town. Afterwards, they will put some water and ice and then they will state what will happen when the ice melts.

Step 4:

The children will be shown a map of Malta. On the map, the children will follow the legend and state which parts of Malta are low and which parts of Malta are high. Afterwards, the children will be asked what would happen in case of rising sea levels in Malta. Additionally, they will also circle on their tablets the towns/cities that would be affected by rising sea levels.

Step 5:

The children will discuss what they can do in order to prevent climate change and the issue that brings about water and climate change.

Step 6:

The children will then share their ideas.

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FOLLOW UP ACTIVITY

Conclusion:

The children will be encouraged to either use the tablet or else draw a poster on what they could do in order to prevent global warming and climate change.

BACKGROUND INFORMATION FOR TEACHERS

Teachers should have background information about climate change and global warming,

Teachers should prepare all of the activities and resources beforehand,

Teachers should go around the classroom when the children are working on an activity to address ant misconception.

Teachers should keep in mind that this activity is targeted for 8 - 9 years old, thus, students may need other examples to reinforce certain activities.

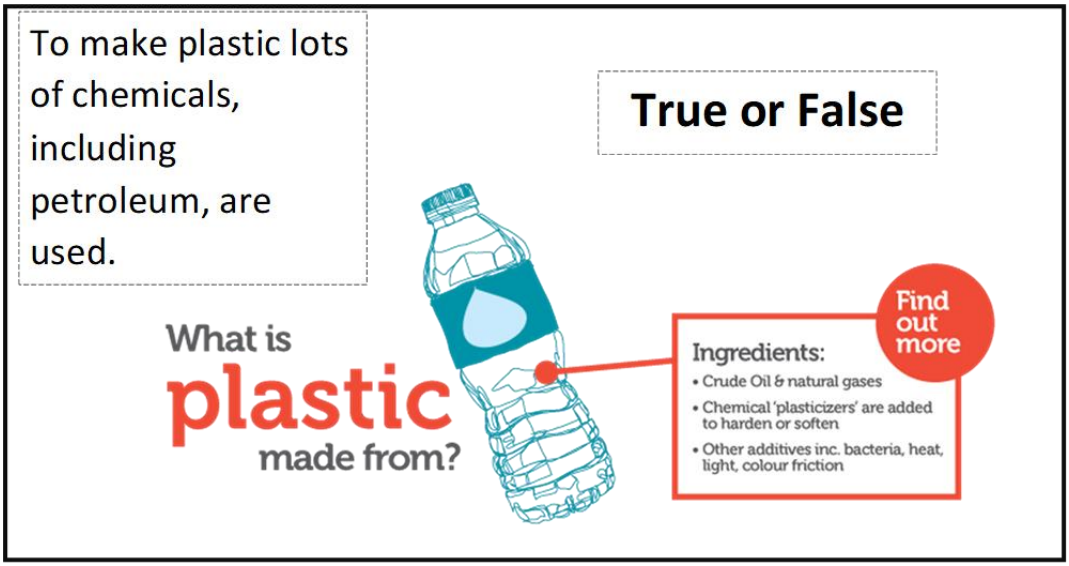
EXTENSION

Teachers can ask the students to write on a diary, what are the children doing daily in order to mitigate the effects of global warming and climate change.

REFERENCES

Video: https://www.youtube.com/watch?v=Sv7OHfpIRfU

APPENDIX



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OCEAN INVISIBLE KILLERS

ScienceJam Compendium 2019

Authors: *Fiona Vella Ciangura & Nadia Borg*

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

THEME

The effects of ocean acidification and plastic pollution on marine life with the aim of raising awareness amongst students.

KEYWORDS

Ocean acidification, acid, marine life, plastic pollution, microplastics, plankton, food chain, climate change.

SUGGESTED AGE

12 to 14 years

ACTIVITY DURATION

This is not just an activity, but it is meant to be a learning experience consisting in different tasks to help students learn about the hidden story of plastic. This activity he lesson duration is divided into 3 sessions of 40 minutes each.

Session 1: Introduction

- Match game, Video, Discussion

Session 2: Microplastics

- Clean-up activity
- Microplastics investigation: Examine soil sample under microscope

Session 3: Ocean Acidification

- Ocean acidification experiment in lab
- Video ocean acidification and NASA online game
- Conclusion
- Follow-up: conclusion and presentation of results

SITE

On school premises but the hands-on activity can be done outside of school.

RESOURCES REQUIRED

Laptop and projector for videos (online)

Flashcards for ‘match’ introductory activity

For soil sample: gloves, plastic bags, and microscope

For clean-up- recycling bags, gloves, camera, scales

For ocean acidification experiment- school lab, cups, sea shells (preferably collected the day before, washed and dried), acid (vinegar or Carbonic Acid) scale

CONNECTIONS TO OTHER SUBJECTS

Geography

Biology

Chemistry

Environmental Science

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

Education Objectives

- Linking global problems to everyday behavioural choices
- Tapping different learning styles to meet different students
- Connecting classroom lessons to real life scenarios
- Become aware of how important it is to take care the natural environment
- Improve their skills in working in groups
- Improve their thinking skills : prediction, analysis, critical thinking
- Linking different subjects together

Learning Outcomes

This activity will help students:

- Learn that plastic is made up mainly from crude oil.
- Realise that plastic does not decompose, but instead breaks down and ends as micro plastics which are found in the sea, sand and other ecosystems and entering the food chain.
- Understand the importance of plankton in the food chain and marine ecosystems.
- Understand that the same production of plastic (amongst other manufactured goods) produces Carbon Dioxide which ends up being absorbed by the ocean. Moreover, when Carbon Dioxide dissolves in the ocean it forms Carbonic Acid which increases the risk of having ocean acidification.
- Carry out an investigation to predict possible scenarios and understand how carbonic acid can make the water acidic and in turn dissolve calcium in shells.
- Understand that this process increases global warming in various ways.
- Become aware that this is a global problem, but we all need to act now.
- Propose solutions.

PREPARATION FOR TEACHERS

Teachers need to be knowledgeable about how ocean acidification is linked to global warming and climate change.

Teachers should prepare the necessary resources needed for all the activities/lesson.

Teachers should collect some shells beforehand and try out the experiments before to see if they work and know exactly what they need to do.

A list of keywords and definitions might be prepared to keep handy as a reference for students.

PREPARATION FOR STUDENTS

Prior this lesson students should know about energy resources, global warming and climate change.

Optional: Students can be informed about key words to familiarise themselves with the topic.

OUTLINE OF THE EDUCATIONAL ACTIVITY

Session 1: Introduction (40 minutes)

Activity 1: **'Match' activity**: How much do you know about climate change and plastic production? (10mins)

Students are presented with eight diagrams and eight statements (see Appendix 1). They need to decide if the statements are true or false by finding and analysing the corresponding diagram.

Teacher led enquiry based discussion: Teacher goes through the flashcards to see what students wrote and discuss each diagram. If necessary use bbc videos or books to clear any doubts on such topics. (15 mins)

Activity 2: Watch Video – students watch the video '*Plankton munching microplastics*' (Bo Eide, 1st Feb, 2014) to understand more about what really happens and what scientists have found out. Online available: https://www.youtube.com/watch?v=2oQeXhURTgY

Discussion: Questions following the video include: (15 mins)

- What is plankton?
- What is their role in the foodchain?
- Why are they also important?
- What are they eating?
- Where did that plastic originate from?
- Who is responsible? See Picture 1 and 2.

Session 2: Microplastics (40 minutes)

Activity 3: **Outdoor activity** – Students will be instructed to go outside to conduct a clean-up activity. (30 mins)

Instructions given to students:

- Take gloves and a bag.
- Collect as much plastic as you can from the area around school (or organise an outing).
- Take photos of what you find.
- At the end of the session weigh your bags.
- Give them a time limit to conduct the activity .
- Important note: Make sure you collect some soil from the same spot of the clean-up.

When the activity is ready, ask the students to check how much plastic they collected and compare with the each other. If possible, hold a small discussion and ask them what they think, what their feelings are? And repeat the question: who is responsible for the plastic waste? See Picture 3

Activity 4: **Soil Investigation in lab.** (10 mins)

Students take some soil samples that were collected during the clean-up activity and check it out under the microscope to see if / how many / how plastic pieces are. See Picture4.

As a conclusion of this session analyse and discuss with the students the results of the soil investigation. Questions to prompt the students:

- Did you find any plastic material?
- Does it finish or does it break down into even smaller pieces?
- What are these pieces called?
- Is this a problem?
- What will happen if the current trend continues?
- Can we do something?

Session 3: Ocean Acidification (40 minutes)

Activity 5: Ocean Acidification Experiment – Students carry out investigations to check if different amounts of Carbonic Acid in the sea dissolves shellfish at different rates. In this way, they will link the problem of plastic production and pollution to the effect it will also have on the ocean and marine life. (25 mins)

Method:

Fill 4 glass containers:

- Each must be filled with 10 ml liquid- first will be 2 ml carbonic acid and 8 ml water, second will be 3 ml acid and 7 ml water etc,
- Put some shells at the bottom.
- Check ph. level and label container with date and ph. level

- After 7 days check if the hardness of the shells change and / or how much the shells dissolved (by filtering it and weighing the shells to be compared with the initial weight at the start of the experiment). See Picture 5 and 6

Students can be given the following link to be accessed at home and investigate coral bleaching. NASA Climate Kids. Online available: https://climatekids.nasa.gov/coral-bleaching/

FOLLOW-UP ACTIVITY

Conclusion: Complete the circle to identify the ocean invisible killers!

Students present a collage of pictures of their work and / or findings together with other images they find online to illustrate, in simplistic terms, the whole issue of plastic production and pollution and ocean invisible killers. See Picture 7

BACKGROUND INFORMATION FOR TEACHERS

Teachers should have background information about the topic in question

Teachers should be aware of the mixed abilities in their classrooms and adapt the work accordingly.

Teachers should prepare questions beforehand to prompt students when it comes to discussions just in case students get stuck.

Teachers should check with their schools if they need any consent forms before doing any activities at school or outside of school.

Teachers should see that the labs are available for the duration of the session.

Teachers should accompany studies throughout the sessions.

ADAPTATION

Adapt any necessary work/activities according to the needs of the classroom.

A part of the overall activity can be chosen (e.g. only microplastic)

EXTENSIONS

This can be part of a bigger project/ investigation the students can do as part of their SEC exam. A questionnaire to understand the general public / leader' opinion and knowledge about the mentioned issues can be carried out.

The following questions can also be tackled:

Follow up of this activity as research at home and this will be presented/ published on the school website. Students will be divided into groups of 4 and they must choose between option 1 and option 2 or both. Where possible photos / images of the research should be included. Work can be presented as a ppt, word document, poster, or writeup.

Option 1:

1. What is plankton?
2. Name two important roles of plankton:
3. What is plastic made of?
4. Does plastic finish?
5. What happens to plastic once it is dumped away?
6. What are microplastics?
7. In what way do they end up in the food chain?
8. How can this be a problem?

Option 2:

1. What happens to the pH of the sea when too much chemicals and Carbon Dioxide is dissolved in it?
2. How can this in turn effect shellfish and coral reefs (which are like nurseries in the sea), fish in general?
3. Are there any other effects?

- What should be done?

SUMMARY

An enquiry-based set of activities to help students learn about two main environmental problems: micro plastics in the ocean and ocean acidification, which are both linked to climate change. Plastic is an added problem to climate change, and since plastic does not decompose, it ends up in the food chain. Furthermore, plastic pollution and CO2 add to ocean acidification which affect the composition of water and marine life. Through this lesson students are also encouraged to participate in different activities such as match sentences, watch videos, do a clean-up, investigate soil, carry out an 'ocean acidification in a cup' experiments, and to think about solutions.

REFERENCES

https://www.noaa.gov/education/resource-collections/ocean-coasts-education-resources/ocean-acidification

https://www.nationalgeographic.com/environment/oceans/critical-issues-ocean-acidification/

https://www.youtube.com/watch?v=2oQeXhURTgY

FURTHER READING

https://climatekids.nasa.gov/coral-bleaching/ - very good as a follow up activity at home especially for the low achievers.

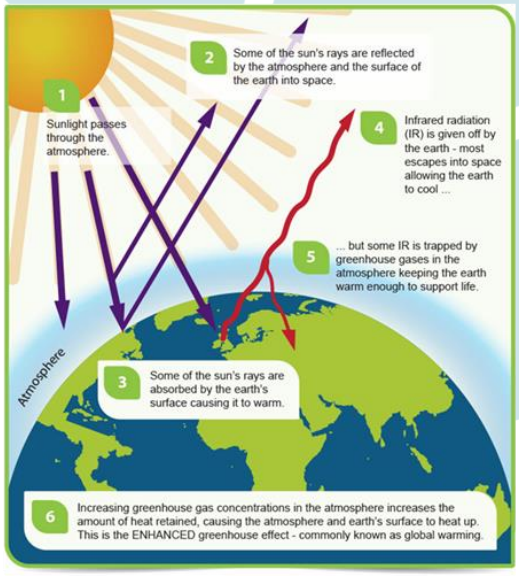
ACKNOWLEDGEMENT

We would to thank our schools; St. Aloysius College Secondary and Maria Regina Mosta Secondary, for helping and supporting us. We would also like to express our gratitude to Profs Paul Pace for giving us this wonderful opportunity to be part of EduChange Project and for his support. This opportunity was an enriching experience that helped us to grow both personally and professionally.

APPENDIX 1 – ACTIVITY 1 : MATCH

Climate change is the increase in world temperatures caused by an enhanced greenhouse effect.

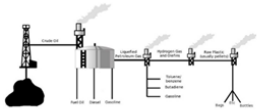
True or False



Plastic is made out of a clean, renewable resource.

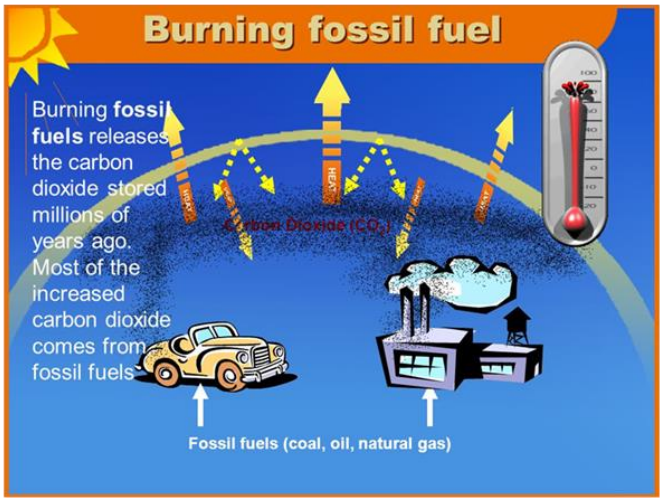
True or False

Plastic Refinery Process



Today lots of Carbon dioxide is released in the air (plastic production, burning of fossil fuels in factories, transport, power stations etc)

True or False



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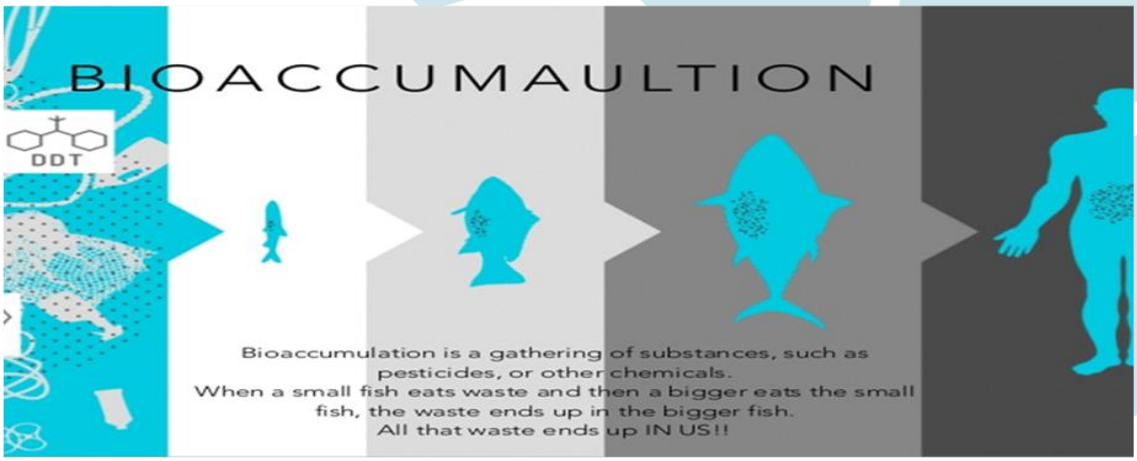
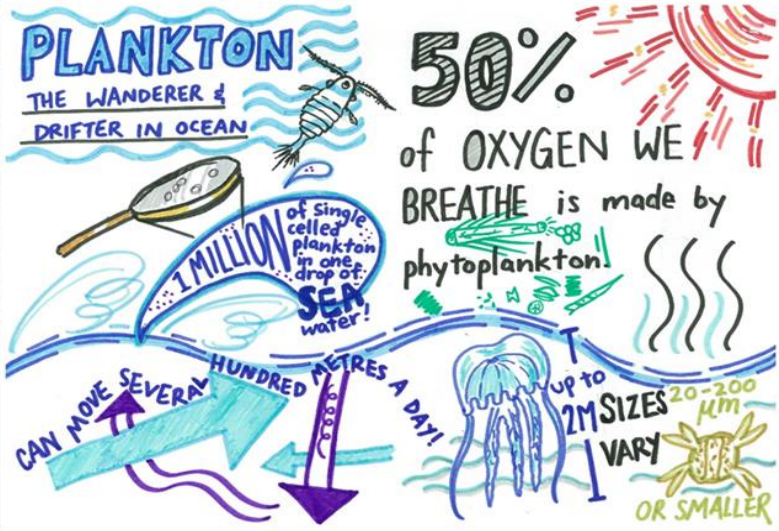
It is healthy to eat plastics and chemicals.

True or False



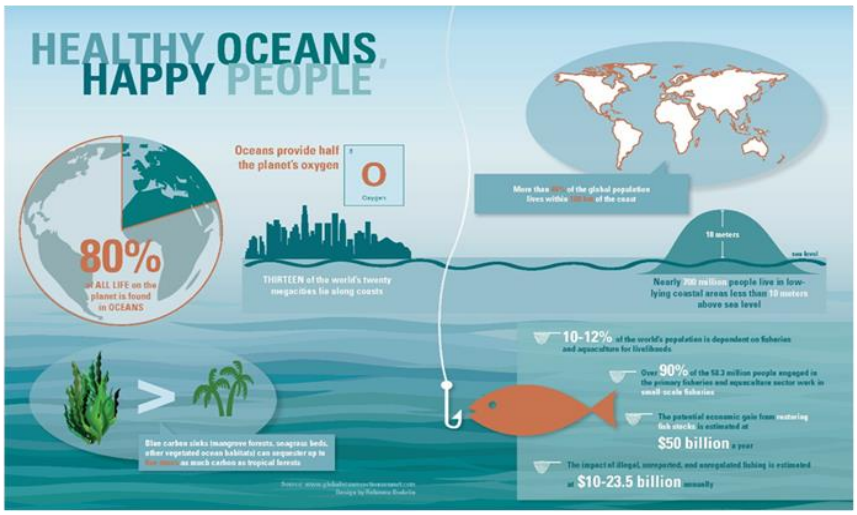
Just like plants and trees, Zooplankton and bacteria take up CO2 and gives out oxygen in the sea.

True or False



Having healthy oceans is not important as we live on land.

True or False



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2017-1-CZ01-KA203-035519

STUDYING WATER ISSUES IN STUDENTS' OWN LIVING ENVIRONMENTS THROUGH THE USE OF STORYMAPS

ScienceJam Compendium 2019

Authors: *Bob van Berkel, Martijn Gerritsen & Iris Huurdeman*

Co-funded by the
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THEME

Adaptation measures that can counter water issues in students' living environment.

Adaptation measures are policy measures or interventions in public space that can be taken to prevent or solve problems.

Water issues are problems arising from excesses or shortages of water due to, for example, excessive precipitation or severe droughts.

Students' living environment concerns the area that students live or go to school in.

SUGGESTED AGE

Age: 15 till 18 years

Suggested class: 10th or 11th grade

ACTIVITY DURATION

60 min: introduction and explanation of the assignment (in class)

120 min: homework + fieldwork (in students' own time)

60 min: presentation and evaluation (in class)

SITE

60 min: classroom with beamer

120 min: students do research in different neighborhoods in their own environment + computer room

60 min: classroom with beamer

RELATION TO CURRICULUM

The activity in particular relates to two 'domains' of the Dutch Geograhpy curriculum for 'havo' (education that prepares students for studies at university of applied sciences): 1) living environment and 2) geographical competences.

Key topics from these two domains that the activity is related to:

- Flooding risks and water issues in the Netherlands
- Policies taken to prevent flooding and water issues (in the Netherlands)
- Making use of maps to approach geographical queries and issues
- Making use of Geo-ICT applications to approach geographical queries and issues
- Recognizing and formulating geographical questions

- Comparing phenomena and areas across time and space and contextualizing them meaningfully

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography (social and physical)

Geology (soil types and hydrology)

Biology (vegetation types)

Social studies and Political studies (water management and policymaking)

Physics & Chemistry (water pollution)

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

Learning outcomes relating to content knowledge

- Students recognize (locations with) water issues in their living environment
- Students analyze how water issues arise in given locations in their living environment
- Students evaluate existing and suggest new/revised adaptation measures to be taken to prevent water issues identified in given locations

Learning outcomes relating to geographical skills

- Students can create a storymap communicating their evaluation of identified (locations with) water issues in their living environment

REMOTE PREPARATION

It is important to note that, in order to be able to complete this activity, it is necessary for the students to already have considerable knowledge about the reasons, measurements and consequences of water issues in their local context and how this relates to climate change. Therefore, this assignment is suitable for, for example, closing off a chapter or lesson series about water issues.

The following questions should have been addressed before students embark on the assignment:

- Which water issues can occur due to climate change in the local context?
- Depending on the local water issues, what adaptation measures could be taken to counter them and what they would look like?
- What are the advantages and disadvantages of the different adaptation measures that can be taken in the local context?

PLANNING CONSIDERATIONS

In this teaching activity, the main assignment is to be completed by the students outside school time. If this is not feasible, students can be given time to work on their assignment during class. For convenience, these classes could take place in a room with computer facilities.

RESOURCES REQUIRED

When working in groups, at least one of the students in each group should have a photo camera or a smartphone with camera in order to take pictures.

In order to create storymaps, schools will have to have a public (free) ArcGIS online account. If schools have no access to ArcGIS online, other tools can be used instead. Examples are Google Earth, My Google Maps/Streetview, QGIS. Alternatively, students can be given an analog map of their local area and prepare a photo presentation (e.g. in PowerPoint or on a poster).

OUTLINE OF THE EDUCATIONAL ACTIVITY

Overall goal

The main goal of the teaching activity is to introduce students to local water issues that could arise in their own living environment, to policy measures that could be taken to tackle these issues, and to invite students to reflect on these issues and adaptation measures through creating storymaps.

Introducing the activity

The first part of the teaching activity consists of two introductions, one focusing on the content regarding the theme (water issues and measures that can be taken in the local environment) and one on explaining the story map assignment (how to use the tool and specification of the assignment details). In our specific case, we used one class (60 minutes) for both components, using a bit more than half of the allocated time for content-related elaboration. Depending on the tool that is used, time allocation can differ.

Description of story map assignment

Students will explore the neighborhood where they live individually or in small groups (maximum 4 students). The goal of the assignment is to get insight into the water issues that this neighborhood faces.

Students are asked to take at least 5 photos of locations in the neighborhood where water issues (can) arise and at least 5 photos of locations where visible adaptation measures have been taken.

Students will provide a short yet meaningful explanation for why they took photos on given locations (what is there to see on the photo and how does this show water issues

or adaptation measures?) and insert the locations and accompanying photos in a storymap.

Using My Google Maps (https://www.google.com/maps/about/mymaps/), students can create a 'New Map', on which they can highlight certain locations using the search and icon bar (see figure 1), as well as add accompanying texts and photos to these highlighted locations (see figure 2). Having added all locations to the map, they can share the map digitally with their teacher.

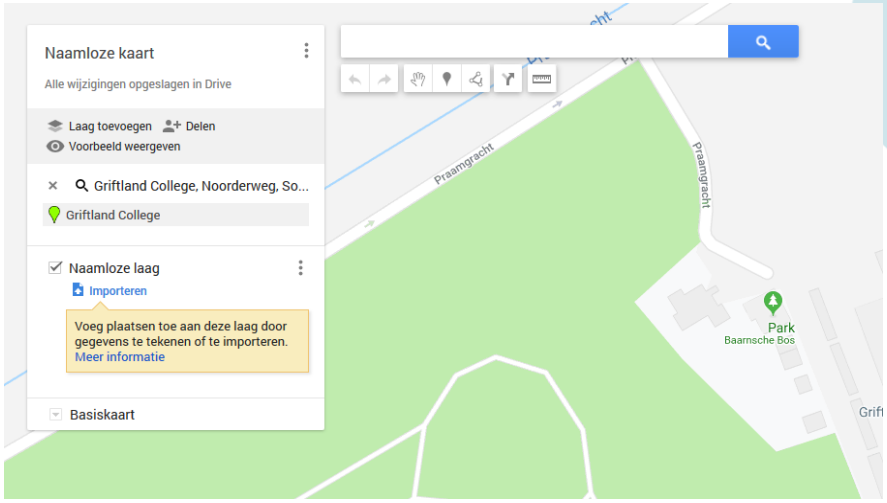

Figure 1.

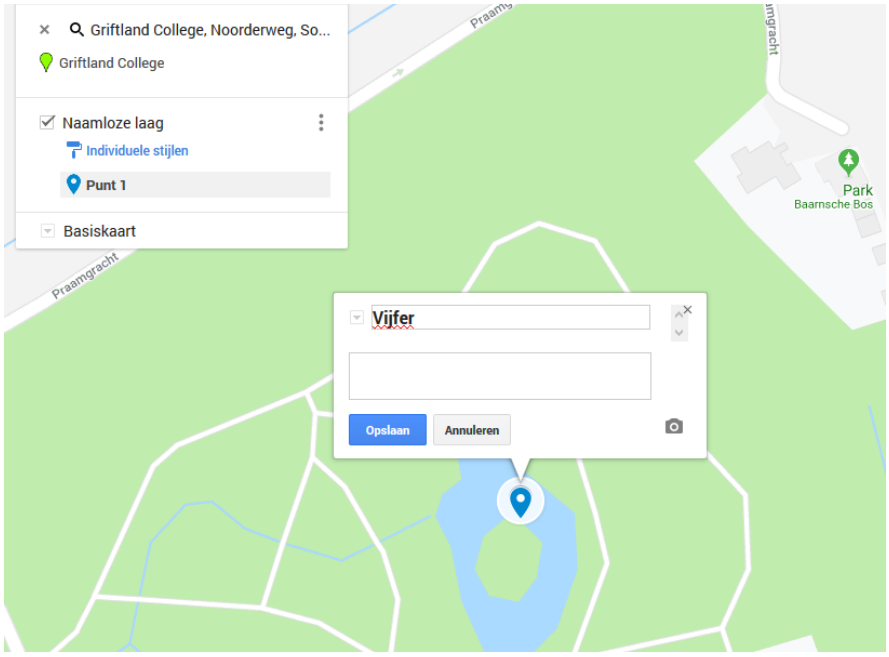

Figure 2.

Concluding the activity

In groups, students will present the storymaps they created to their fellow students and teacher. Students will assess each other's presentations and provide each other with feedback, for which a rubric is provided (which could be co-drafted by the teacher and students).

FOLLOW-UP ACTIVITY

The outcomes of the activity (storymaps and presentations of students) can be used to thematically discuss local water issues and the measures that could be taken to prevent them. See 'Extensions' for suggestions on other follow-up activities.

BACKGROUND INFORMATION FOR TEACHERS

Example of a storymap indicating locations where water issues may arise after heavy rainfall (in Dutch): https://uni-utrecht.maps.arcgis.com/apps/MapTour/index.html?appid=919a16581faa40b8a8671e8fc902e2fd

Dutch description of how the activity can be used in classrooms, including an instruction of how to create storymaps using ArcGIS Online: https://community.esri.com/docs/DOC-12836-onderzoek-in-de-eigen-omgeving-naar-wateroverlastdocx

ADAPTATIONS

If a class has some students with learning difficulties, these students could be grouped with more advanced students in order to stimulate their learning process. Another option could be to take the whole class out into the school's neighborhood and walk a given route, along which the teacher points out locations with specific water issues and adaptation measures (instead of students exploring their living environment individually). Students can in this case prepare their presentation in a classroom with computer facilities. In this context, the assignment is more teacher-led.

EXTENSIONS

Gifted students could be given the task to, in addition to compiling a storymap, write a policy proposal addressed to the local municipality in which they outline how the public space should in their opinion be altered. An opportunity could also be to invite a local policy maker or an expert on water management to look at and evaluate the students' presentations.

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SUSTAINABILITY GAME

ScienceJam Compendium 2019

Authors: *Guido Kuppen, Renske Hoekstra and Dinette Hakkesteeg*

Co-funded by the
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of the European Union

THEME

Awareness of choices in daily life and the consequences that are related to those choices.

SUGGESTED AGE

12 to 14 years old

DURATION

One lesson of 60 minutes

RELATION TO CURRICULUM

SLO, Curriculum.nu 2032.

Main goals out of the lower grades of secondary school (human and society):

36. The students learn to ask meaningful questions about social issues and phenomena, to take and argue a substantiated point of view, and to handle criticism with respect.

38. The students learn to use a contemproray image of his own environment, the Netherlands, Europe and the world to place phenomena and developments in their environment.

42. The students learn in his own experiences and choices of choices in work and care, living and recreation, consumption and budgeting, traffic and environment.

POSSIBLE CONNECTIONS TO OTHER SUBJECTS

Geography for sure.

Biology - Daily life choices that connect to global warming are also argued from biological perspective.

Physics - Global warming is a process with a lot of Physics background. So you can combine those elements in the questions.

Economy - There is the money and salary in the game. Its part of economy education to handle with it.

History/social science - Politics has a role in the whole story and there are questions in the game about history.

EDUCATIONAL OBJECTIVES / LEARNING OUTCOMES

The students can make a distinction between the different water problems (drought/ shortages, heavy rainfall, polluted water and floods) on earth and can name the (possible) consequences of these problems.

The students can explain how an increasing amount of CO2 emission has an effect on the earth and its global climate.

The students can use examples to critically reflect on how they can contribute to the reduction of CO2 emissions.

The students can critically assess how they can increase or decrease energy and water consumption, by consciously thinking about choices that relate to everyday life.

The students visualize on the basis of a board game how choices they make during the game can also occur in their own daily life.

REMOTE PREPARATION

In the ideal case, students already have some prior knowledge about climate change. But they don't have to take anything to class or do any other preparations. It is useful to tell the students that there will be an active work form in the lesson.

For the teacher it is important to take all the material with you and to have all the cards in the right order.

PLANNING CONSIDERATIONS

As a teacher you have to deal with some ethical issues. Students can ask if they really have to make those choices in daily life and what the consequences of these choices will be. Hereby it is important to be able to put things into perspective and not to create a utopian image of how they can save the world. It is therefore important that they do not make the choices from themselves but from the character with whom they play.

RESOURCES REQUIRED

The game has all sorts of necessities such as pawns, dices, cards, the game board and the sustainability meter. It is important that you take all of this with you as a teacher.

It is also important that you as a teacher are well-versed in all dilemmas and the pros and cons. It is also good if you can provide background information for the various knowledge questions.

OUTLINE OF THE EDUCATIONAL ACTIVITY

Introduction

The students take one card at the start of the game. This card shows a person with a certain job, a certain income and a certain age. It also shows the view of this person on sustainable choices. They will therefore go through the game as a virtual citizen of a virtual city in the Netherlands. Before the game starts the players are confronted (for the first time) with a choice. This is the choice if they want to travel to work by car or by bicycle daily. With both choices they follow a different route (for part of the game). Every turn, the students throw a dice. This indicates how many boxes the students can move forward. Except if they throw 6. Then they receive a knowledge question that relates to the theme of water, sustainability and / or climate change. If they answer this question correctly,

they may play again. If they are wrong, they stay and their turn ends. Every box that the students can go to has its own meaning. There are different types of boxes.

Development

During the game the students can end up on different boxes. The types of boxes they can have are the following:

Check boxes with a knowledge question. The students must answer a knowledge question related to the theme of water, sustainability and / or climate change. When they have received this, they will receive a sustainability point. If they receive a wrong answer they will not receive it. In both cases their turn ends after answering this question.

Boxes with a dilemma. The students have to make a choice in these boxes. These choices are varied, but all relate to choosing a more sustainable alternative or not. There are advantages and disadvantages for both choices, which they will also come into contact with during the course of the game.

Salary boxes. The students receive the money that is stated on their personal card. Even if they do not exactly end up on this box, but cross it, they will receive this salary.

Job-related boxes. When the students come to this box and the box relates to their profession, they must stop here. They will be given an advantage, disadvantage or choice to process that has a direct link between the specific profession and the issues that are central to this project.

Positive / negative event boxes. When the students come to this box, they have no further choice and influence. They must perform the action stated on the box.

STOP boxes, with specific direction of choice. After these boxes, the route splits. The students choose which route they will take based on an issue. For example, there is a choice about traveling via a bridge or with a ferry. There is also a specific optional course that can be related to the holiday choice. One route goes to Mexico by plane, the other route to Paris by train. With this and the other option-oriented boxes, they are considered within the chosen route with water and sustainability issues that can be related to the choice they have made.

Conclusion

There is no follow up activity. But there is the possibility to make links with the game in your teaching material. If you are going to teach sustainability lessons in the follow-up lessons, you can make links with the choices you make during the game. So there are possibilities to link the activity to further course material. And this is also possible in the form of a follow-up discussion.

FOLLOW-UP ACTIVITY

The main follow up activity is the discussion afterwards. The discussion can be used to eliminate the stereotypes that may occur in the game, even though the makers of the game tried to prevent that by base the characters of the game on a research. Despite the effort, stereotypes may still be in the game. That is why the discussion is important.

Besides the stereotypes, the discussion is the perfect moment to talk to the students about the choices in the game and how they can use the information and what they learnt in their daily lifes.

Another suggestion is to play the game again, but this time in another perspective and another character. In that way, the students will maybe see the differences in the choices en motivations for the choices and learn even more that sustainability is also dependent on money and the way people think.

BACKGROUND INFORMATION FOR TEACHERS

It is important that the teacher reads the background information well. It must also be aware of the advantages and disadvantages of the various options for dilemmas. In addition, the teacher must be able to lead the discussion. The teacher is therefore aware of the different choices that the students can make during the game. The teacher must also be able to provide more information about the background of the knowledge questions.

ADOPTIONS AND EXTENSIONS, DIFFERENTIATION

There is a possibility to classify the groups on a knowledge level. The groups that have less difficulty with the course get the more difficult knowledge questions. However, this is not something that is most important in this game. It is therefore a possibility, but certainly not a necessity, to differentiate.

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