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The Key To Global Life,
Digital Change Of Nature



Total Duration: 3-5 days



Student's Age: 12-18 Years



Application Area:

- Geoscience,
- Hydrology,
- Global warming.



Keywords: Deep ocean currents,
density, entities, convection,
global conveyor belt, Convection
cells



**G5 - Losted Ways
(Penguins)**



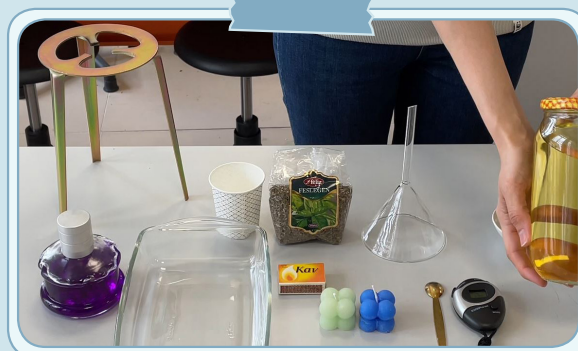
Module

- Global Warming

G5 - English Version

Materials:

- Heat resistant glass deep container
- 2 teaspoons dried thyme (another dried spice may be available)
- Teaspoon
- 4 water glasses vegetable oil
- Measuring cup
- Paddle
- 2 ceramic coffee cups. (Their height must be equal.)
- Small candles or sterno fuel (Ottoman furnace fuel)
- Lighter or match
- Paper for sketch
- Thermometer
- Ruler
- Stopwatch
- Funnel
- Lab book



Notes:

- Candles and sterno fuel boxes should be shorter than ceramic mugs, Please choose to avoid being too close to the glass container.
- Teacher helps recommends during the activity process.



@digitalchangeon

Introduction

It is stated that climate change may adversely affect the penguin population in Antarctica. According to a study, it is stated that penguins, whose number reaches 600 thousand, may decrease by one fifth by 2100 (Cristofari et al., 2018).

Studies states that the main threat to this bird species living in Antarctica is the change in the sea-ice ratio. Accordingly, if the rate of ice and water in Antarctica changes, the reproduction and feeding of penguins will be adversely affected. The studies argues that different dynamics will be effective among penguin groups, but still the numbers will decrease in all groups.

Penguins travel from one place to another for months, looking for food. Penguins spend months looking for food to feed their young. Penguins, who travel long distances along the Antarctic glaciers, gather food such as shrimp from the places where they reach the sea (Picture 1).



Picture 1. Lost penguins



Picture 2. Penguins

Penguins need an ideal amount of glacial layer for various reasons, such as protection from predators while looking for food. Changes in the amount of glacier and sea also affect the productivity of creatures such as shrimp that penguins feed on.

The reproduction of shrimp and similar shellfish, which are the main food source of penguins, is affected by the glacial marine distribution. The increase in glaciers is considered positive for shrimp and other crustaceans. However, this means penguins travel longer distances to reach the sea (Picture 2).

Satellite measurements show that the ice-water level in Antarctica has risen to an unprecedented level. Changes in water temperature cause penguins to lose their way. For this purpose, this study will be carried out.

This activity consists of two stages. In the first phase, a model of ocean currents will be designed and observed how heat surplus affects the current rate. The second phase will focus on how these currents have a negative impact on penguins or other creatures living in polar regions. To draw attention to this incident, a penguin will be designed through tinkercad and 3D will be printed.

Considerations

- Candles and sterno fuel boxes should be shorter than ceramic mugs, Please choose to avoid being too close to the glass container.
- Teacher helps recommends during the activity process.

Aim of the Activity

This activity teaches students a number of skills, including the scientific method and communication using 21st century skills such as posting their work online in the form of a video or blog for the consideration of their peers. They will research bioplastics in order to understand why their development could be favorable for society and they will engage in numerous iterations to refine a standard bioplastics procedure to create the best product that they can.

- At least 2 different methods are tested, this template describes the method with milk and vinegar;
- To report results by conducting experiments (students make a movie to promote their final product to potential clients, explaining the motivation behind making bioplastics, the procedure followed, and why their product is worth buying);
- To improve the ability of spatial-visual intelligence when designing jewelry;
- To gain awareness of the concept of bioplastics;
- To use Tinkercad and 3D printing (the mold to make the product is 3d printed).

Activity Process

Before Activity



- Give information about conventional currents seen in the oceans is given before starting the activity (Picture 3).
- Please watch how easily penguins made, DIY. (Colorfulworld, 2018)



Picture 3. Preparations of activity



<https://www.youtube.com/watch?v=Es-rCelq6YU>



Teacher asks to students to find answers to the following research questions.

- What kind of currents are found in the ocean?
- How does ocean currents affect the air?
- What is the role of ocean currents in distributing nutrients?
- What is the energy that drives ocean currents?

Let's Start

1 Making model

- Place the baking tin on two ceramic glasses (Picture 4).
- Observe the mixture of oil and spices. Without adding any heat (energy) to the system, the fluid should move very little or not at all after it has collapsed.



Picture 4. Place the glasses



Picture 5. Light the candle

- Place a candle directly in the middle of the oven tray. Make sure that the cups support the baking tin steadily. You can also use a sterno fuel instead of a candle.
- Light the candle and let the liquid heat up for at least one minute. After the heat is applied, the conventional current is expected to start (Picture 5).

- When the oil warms up and starts to flow, observe the fluid flow (circulation) pattern by noting the location of the thyme washers over time. Write down all your observations in your lab book. This type of energy flow is called thermal convection. Because the added heat reduces the density of the fluid, causing fluid flow (Picture 6).



Picture 6. Spices

- Keep the model steady and record your observations by giving the heat source from the cab right to the left (Picture 7). Offer from your students:

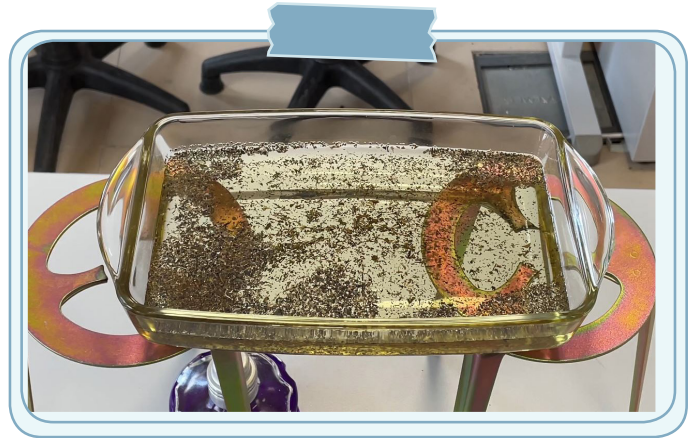


- Sketch the shape of the flow according to the direction of the heat source.
- Write the answer to the following questions in your lab book.



• Ask the students:

1. When you observe the current pattern, in which areas of the cab do you observe the flow up, down and horizontal?
2. Is the oil temperature the same in different parts of the model?
3. What is the difference between the highest temperature and the lowest temperature?
4. What is the distance traveled by a thyme grain (measure with a ruler) and the time (measure with a stopwatch) for this movement?
5. What is your observation of the thyme movement in the area near the heat source and the thyme movement in the remote area?
6. What did you observe when you increased the heat source by 2-3 times?
7. How can these hot currents affect penguins' migration paths?



Picture 7. Fluid flow

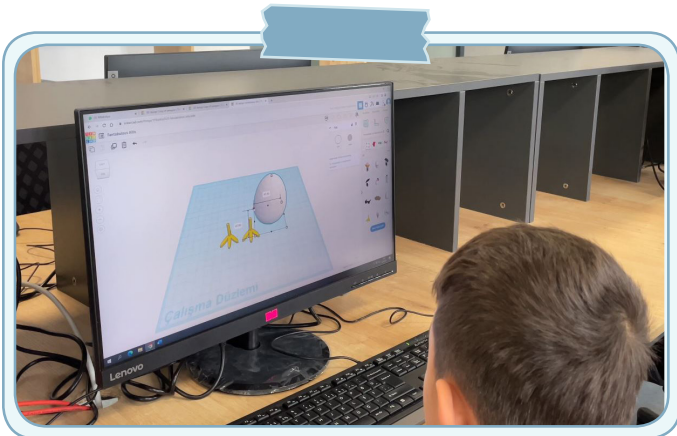
2

Design and print penguins in 3D models



Students can use 2 ways to make penguins. Use stock templates in Tinkercad.

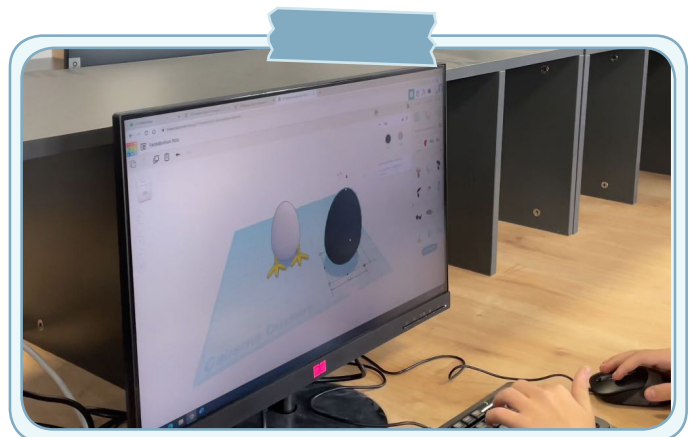
- <https://www.tinkercad.com/things/kBL607qMgMZ-copy-of-penguin/edit>
- <https://www.tinkercad.com/things/jYycryUc0Ls-copy-of-penguin/edit>



Picture 8. Making penguins with Tinkercad

Design with your students.

1. Sign up for the program and open a new sheet.
2. Select the sphere on the worksheet. Rub on the sheet. Select height 60, width 40 cm (Picture 8).
3. Turn the sphere black.



Picture 9. Making penguins with Tinkercad

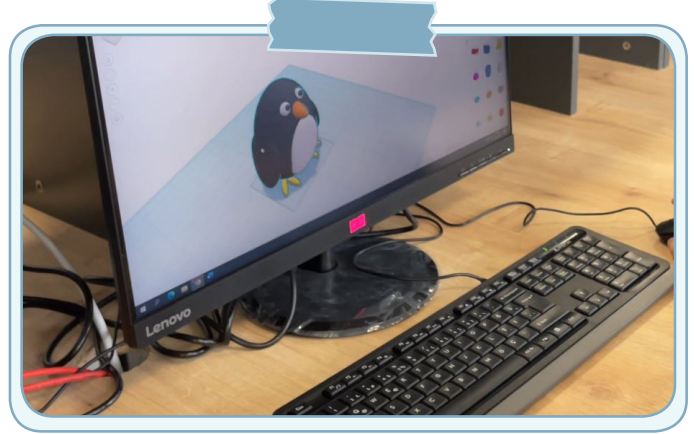
4. Copy the black sphere with the same size (Picture 9).
5. Paint the second sphere white
6. Follow the design steps from the video below and get the print



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

3 Development

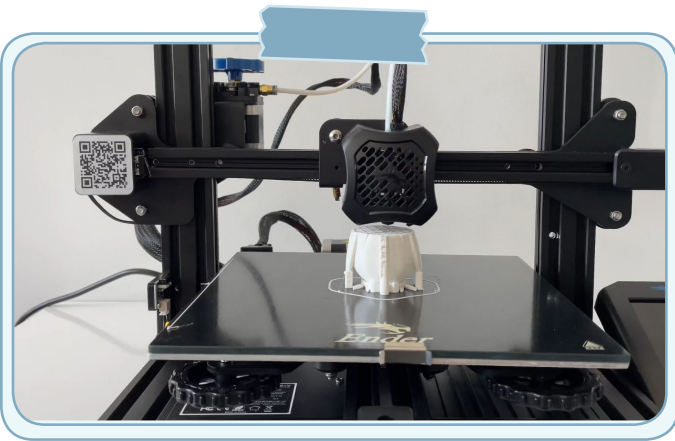
If you want to develop your penguins, you can try Arduino sets. Environment sensors are of great importance in embedded applications. Many temperature sensors measure the ambient temperature or temperature of a surface. For measuring water temperature and other fluids, waterproof temperature sensors are required. One of such temperature sensors is DS18B20.



Picture 10. Making penguins with Tinkercad

This sensor can measure the temperature of the air, liquids like water, and ground. The sensor comes in two form-factors, of which one is a waterproof module. It can be used to sense temperature in applications like electric steam cookers, electric kettles, and temperature-controlled water storage.

For try use make your penguin to follow temperatures. So try 1 step you can try and see how is penguins affected by the temperatures.



Picture 11. Printing 3D

Assesment

Evaluation

- The design of students can be displayed within the school. Different products can be created by diversifying waste materials used.

Goals	Must be Improved (1)	Medium (2)	Good (3)	Very Good (4)
Task sharing, teamwork, effective communication during group work	(.....)	(.....)	(.....)	(.....)
The process of designing scientific experiments	(.....)	(.....)	(.....)	(.....)
Ability to use Tinkercard	(.....)	(.....)	(.....)	(.....)
Ability to use digital tools in the research process	(.....)	(.....)	(.....)	(.....)
Sensitivity to occupational safety	(.....)	(.....)	(.....)	(.....)
Total				

Links

- Colorfulworld. (2018). How to easily make a penguin, ice and igloo for a small amount of money / DIY. <https://www.youtube.com/watch?v=Es-rCelq6YU>
- Cristofari, R., Liu, X., Bonadonna, F., Cherel, Y., Pistorius, P., Le Maho, Y., . . . Trucchi, E. (2018). Climate-driven range shifts of the king penguin in a fragmented ecosystem. *Nature Climate Change*, 8(3), 245-251.
- ScienceBuddies. (2020). Ocean Currents: Modeling the 'Global Conveyor Belt' in Your Kitchen. Retrieved 10/10/2022 from https://www.sciencebuddies.org/science-fair-projects/project-ideas/OceanSci_p012/ocean-sciences/ocean-currents-modeling-global-conveyor-belt
- <https://www.sciencebuddies.org/stem-activities?s=global%20warming>
- <https://www.sciencebuddies.org/stem-activities/polar-ice-caps-melting>
- https://www.sciencebuddies.org/science-fair-projects/project-ideas/OceanSci_p015/ocean-sciences/will-ice-melting-at-poles-cause-sea-levels-to-rise
- <https://www.tinkercad.com/things/c3BkCJdQxel>
- <https://www.tinkercad.com/things/9UeZJTri0zD>
- <https://www.youtube.com/watch?v=Gkw45JaEQio>
- <https://www.youtube.com/watch?v=ztQYbRwBboU>
- <https://science.howstuffworks.com/environmental/earth/oceanography/ocean-current.htm>
- <https://web.ics.purdue.edu/~braile/edumod/convect/convect.htm>