

Aktivität 3.7. Das Sonnenlicht/Die Sonnenenergie

Cultural Background

Der Klimawandel hält in Deutschland seit Jahren an. Die Gründe dafür sind vielfältig, können aber unter anderem auf die zunehmende Urbanisierung zurückgeführt werden. Die Zunahme von Neubaugebieten, gekennzeichnet durch viele Häuser auf engem Raum, führt zu der eben genannten Urbanisierung. Die Farbe der Dächer hat großen Einfluß auf die Temperaturunterschiede die durch die Urbanisierung entstehen können. Das Phänomen wird als urbane Hitzeinsel bezeichnet.

In *Waldsee*

Environmental consciousness is very important to the Waldsee community, global warming and climate change are topics that our community is aware of and we discuss our role in it.

In the Classroom

The weather has a strong influence on urban areas through roof coloring. Students will use this task to discover how roof colors can impact the temperature of urban areas.

Objectives

- **Communication**
 - Students will use German language constructions and vocabulary to talk about different colors and temperatures.
 - Students will use their German to record data and conduct and present experiments.
- **Connections**
 - Students will reinforce and integrate their knowledge of science, math and environmental studies through use of German.
 - Students will understand how different colored surfaces absorb or reflect solar energy.
- **Comparisons**
 - Students will be able to use their German to compare and contrast different experiments and discuss various hypotheses about the results.
- **Communities**
 - Students will build confidence and investment in language learning through the development of autonomy and expertise.

Language Functions in Focus

- Describing different colors and temperatures
- Describing processes
- Evaluating
- Suggesting
- Reporting
- Giving reasons and explaining causality
- Comparing and contrasting

Materials

- 2 thermometers
- Print out from Google Maps, which contains lighter and darker colored roofs.
- Duct Tape
- Watch or stopwatch
- Utensils to record data (pens, paper etc.)
- Sunshine outside or a desk lamp with a 100 watt light bulb

Preparation

With the help of Google Maps, locate an urban area with lighter and darker colored roofs. Print the images to use them for this task. This part can either be incorporated into the task or done by the teacher beforehand. Hint: Using maps from your own community will help generate interest for the students, because of the *Lebensweltbezug*.

Generating Interest

Introduce the task by asking if the students have ever noticed that wearing a black shirt on a sunny will make it seem hotter (*Ist euch schon einmal aufgefallen, dass euch in einem schwarzen T-Shirt wärmer ist als in einem weißen?*). Ask them if they have ever noticed standing barefoot on a blacktop asphalt is hotter than on a lighter surface (*Habt ihr im Sommer, schon mal Barfuß auf Asphalt gestanden? Was ist euch aufgefallen?*). Collect suggestions of why they think that is. Discuss how light is absorbed and then transformed into heat energy. Continue to explain that the albedo of a surface is the amount of sunlight that is reflected. Therefore, materials with a high albedo reflect most of the incoming sunlight, whereas materials with low albedo materials absorb most of the sunlight. Urban areas are full of low albedo materials which leads to them being significantly warmer than nearby rural areas.

As homework, ask students to research Urban Heat Islands and to survey the colors of roofs near school or in their neighborhoods. *Bitte recherchiert zu Hause den Begriff "Urban Heat Island" und schaut euch um, welche Farbe die Dächer in eurer Nachbarschaft haben.*

Presentation and Practice

1. Separate the students into groups and have them look at map printouts. Let them identify the roof colors and ask them think about possible hypothesis about which roofs they think would absorb solar energy the best and which would absorb solar energy the worst. *Formt Gruppen und schaut in euren Gruppen auf die ausgedruckten Karten. Überlegt euch Hypothesen welche Dächer am besten Solarenergie absorbieren und welche am schlechtesten.*
2. Students should now fix their thermometers to the back of the map using the duct tape. One thermometer bulb under a darker roof and one under a lighter roof. Make sure the students place the thermometers in a way so that when they lay the map on a table, the thermometers are right side up, so they can be read. *Klebt die die Thermometer auf die Rückseite der Karten. Ein Thermometer mit Glühbirne unter ein helleres und ein Thermometer mit Glühbirne unter ein dunkleres Dach. Achtet darauf, dass ihr das Thermometer mit der richtigen Seite nach oben anbringt.*
3. Place the light (not turned on yet) about a foot above, directly above the map. *Platziert die Glühbirne oberhalb der Karte.*
4. Ask the students to decide which group member is in charge of recording the data, who is in charge of reading the thermometers and who is in charge of keeping the time. *Legt fest, wer in eurer Gruppe die Ergebnisse festhält, wer das Thermometer abliest und wer die Zeit stoppt.*
5. Two students read each of the thermometers before the light is turned on give those temperatures to the student in charge of recording the data (the two temperatures should be approximately the same before the lights are turned on). *Lest die Temperatur ab und gebt die Temperatur weiter.*
6. After recording the initial temperature, groups can turn their lights on the time keeper begins timing. Now, students should take temperature readings, every minute for five more minutes. The thermometers should ideally be read, without shading the light. *Wenn ihr die Ausgangstemperatur festgehalten habt, schaltet das Licht an und fangt an die Zeit zu stoppen. Lest die Temperatur jede Minute, fünf Minuten lang ab. Seid vorsichtig, dass kein Schatten auf die Thermometer fällt.*
7. Let students document their results in a powerpoint (or any other presentation medium) and present them to the rest of the class. Compare results to see if they all got the same results. If not, discuss possible explanations and influences that led different results or data. *Haltet eure Ergebnisse fest um sie euren Mitschülern zu präsentieren und miteinander zu vergleichen.*
8. Talk to students about how this model relates to the real world and where it might not realistic. For example, the models shows the relative differences based on color, but does not take into consideration the the material. Instruct students to brainstorm what else in a city might absorb or reflect sunlight, and talk about the albedo other materials found in urban areas, such as blacktop pavement. *Was haltet*

ihr von diesem Experiment? Ist es realitätsnah? Gibt es Aspekte aus der Realität die das Experiment nicht berücksichtigt?

Wortschatz

Nouns:

<i>das Dach/ die Dächer</i>	<i>das Experiment/ die Experimente</i>	<i>die Sonne</i>
<i>das Thermometer</i>	<i>die Glühbirne</i>	<i>die Ausgangstemperatur</i>
<i>die Hypothese</i>	<i>das Klebeband</i>	<i>die Aspekte</i>
<i>die Stoppuhr</i>	<i>der Asphalt</i>	<i>die Urbanisierung</i>
<i>das Sonnenlicht</i>	<i>der Schatten</i>	

Verbs:

<i>dokumentieren</i>	<i>Zeit stoppen</i>	<i>Temp ablesen</i>
<i>etw. berücksichtigen</i>	<i>überlegen</i>	<i>diskutieren</i>
<i>präsentieren</i>	<i>vergleichen</i>	<i>analysieren</i>

Adjectives:

<i>passend</i>	<i>korrekt</i>	<i>obere</i>	<i>untere</i>	<i>schwarze</i>	<i>weiße</i>
<i>beste</i>	<i>schlechteste</i>	<i>effektivste</i>			

Adverbs:

<i>zuerst</i>	<i>danach</i>	<i>als nächstes</i>	<i>später</i>	<i>zuletzt</i>	<i>schließlich</i>
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