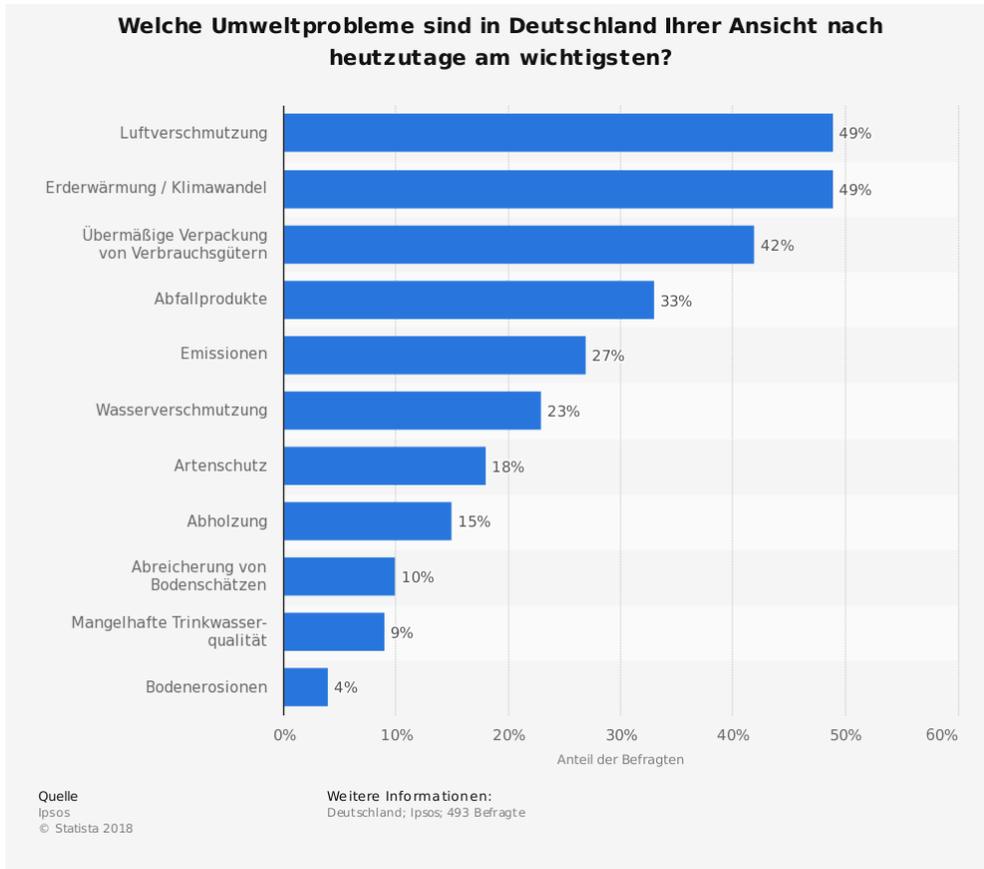


Aktivität 2.5. Statistik und Umwelt

Cultural Background



Die Grafik zeigt das Ergebnis einer in Deutschland durchgeführten Umfrage zu den wichtigsten Umweltproblemen. 49 Prozent der Befragten sahen die Luftverschmutzung neben der Erderwärmung bzw. dem Klimawandel als wichtigstes Umweltproblem an.

In *Waldsee*

In the *Waldsee* STEM high school credit program, students use their German to understand linear equations in algebra. They then are asked to investigate whether or not some statistical inquiries related to nature and the environment can be described with linear models. Students create their own statistical inquiries and collect data related to an environmental phenomenon they can physically identify on the Waldsee site. Such inquiries can relate to plants, insects, wildlife, weather, natural energy, water phenomenon on the lake, etc. They conduct their study and then present their conclusions to the class - *auf deutsch*.

In the Classroom

In this activity, students use their German to work with linear equations in algebra, and investigate whether or not some statistical inquiries related to nature and the environment can be described with linear models. Students use the following mathematical concepts to facilitate and further their knowledge of German and its subject-specific technical language:

- Fractions
- Decimals
- Linear equations
- Line graphs
- Histograms
- Data tables
- Data collection
- Dependent variables
- Independent variables

Objectives

- **Communication**
 - Students will master subject-specific terminology and vocabulary and read, interpret, and solve word problems in a variety of mathematical situations in German.
 - Students will use their German to create, ask and answer questions.
 - Students will employ German language constructions and vocabulary to use linear equations in algebra.
 - Students will formulate if/then hypotheses and posit a series of inquiries.
 - Students will document and present experiments and will use their German to comment constructively on classmates' projects.
- **Connections**
 - Students will reinforce and integrate their knowledge of math and environmental studies through use of German.
 - Students will be able to make connections to their natural surroundings through the German language by generating, justifying and validating hypotheses.
 - Students will further their understanding of cause and effect and methods through which to create sentences with both dependent and independent clauses, through their initial inquiries and explanations and justifications.
- **Comparisons**
 - Students will be able to use their German to compare and contrast different linear equations and discuss various hypotheses about the results.

Language Functions in Focus

- Understanding general vocabulary and technical language
- Following commands given exclusively in the target language
- Interpreting mathematical equations based upon both oral and written story problems
- Indicating agreement and disagreement
- Explaining processes and procedures
- Inferring and interpreting data (verbally and in writing) in the target language
- Justifying an expressed opinion
- Comparing and contrasting
- Evaluating
- Reporting
- Giving reasons and explaining causality

Materials

- paper, straight edge, writing utensils
- data tables, list of data points in two variables
- scientific and/or graphic calculators
- Measuring devices--flexible and/or fabric tape measures (in metric), stopwatches, thermometers, etc.

Preparation

Students require familiarity with two-dimensional graphs, including labelling and interpreting x-intercepts and y-intercepts. They should be familiar with slope-intercept form, $y = mx + b$ (or, in many German texts, $y = mx + n$). Students should understand the basic language surrounding numbers and simple mathematical operators.

Generating Interest

General histograms could be completed on a simple inquiry in the classroom, depending on the level of the students. "Do you like...?" questions could be used for new language learners. "*Welche Profi-Sportart findest du am besten? Was ist dein Lieblingseis? Welche App benutzt du am meisten?*" are all some examples of questions that would elicit multiple responses, and would allow students to express their own likes/dislikes. Expression preferences for one item over another could be used for more advanced students. "*Mir ist lieber ... als... / Ich finde ... besser/interessanter/nützlicher als...*"

A simple graph with the options along the x-axis, and number of people having selected each option along the y-axis would introduce the idea of comparing two quantities (in this case, number of people versus specific item). From here, a general inquiry increasing (positive slope) or decreasing (negative slope) could be introduced/explored, to develop students' familiarity with the topic before starting the activity.

Presentation and Practice

Step 1

First review students' understanding of two-dimensional graphs, including labelling and interpreting x-intercepts and y-intercepts; with slope-intercept form, and with basic language surrounding numbers and simple mathematical operators. "*Schau diese lineare Gleichung an. Wie kann ich den x-Achsenabschnitt berechnen? Wie kann ich den y-Achsenabschnitt finden? Ist die Steigung positiv oder negativ? Wie wissen wir?*"

To start out the teacher asks students to identify five plants that are common to their area. "*Was für Pflanzen oder Pflanzenarten gibt es in...(unser Stadt/unsere Umgebung/in der Nähe von unserer Schule?*" The students should then conduct an opinion survey of other students of German (auf deutsch) to establish how many people recognize the names of the plants. "*Kennst du ...? Was heißt ... auf Deutsch? Auf Englisch?*" This data can be recorded and portrayed graphically and with a short descriptive narrative in German. "*Im [Ort] kann man [Pflanzenart] finden. Die sehen [kurze beschreibung] aus. Sie brauchen viel/wenig Sonne und viel/wenig Regen um am besten zu wachsen.*" This exercise can help students integrate their statistical and German knowledge as a first step.

"*Heute erstellen wir eine Umfrage. Was ist das?*"

Sucht fünf Pflanzen aus, die häufig in unser Umgebung gefunden werden.

Jetzt fragt bitte 15 Personen, von unterschiedlichen Altersgruppen, ob sie die Pflanzen erkennen können.

Schreibt bitte dann diese Daten auf, und die Antworten dann nach den unterschiedlichen Altersgruppen differenzieren. Die Daten dann bitte grafisch darstellen und diese dann mit zwei bis drei Absätzen analysieren und erklären."

After students complete this exercise, the teacher then provides students with hypothetical scenarios and data related to nature and the environment, and asks them to determine what correlation may exist between two known variables, for example the year a tree was planted and its height after 2, 4, and 6 years. They should seek to describe this relationship with a linear equation.

Next, the teacher asks students, either individually or in pairs or small teams, to create their own statistical inquiries, determining two variables, and then to collect data related to an environmental phenomenon of their choice. They should determine what, if any, correlation exists between their data points, and to explain anomalies, outliers, relationships, or the lack of correlation.

Students should be specifically required to create and explore linear relationships in the context of the physical environment around them; they can look at plants, insects, wildlife, or weather, to determine their inquiry, and collect data in multiple areas in their neighborhood, in the school yard, in local parklands or forests, pertinent to their inquiry. They should then record their data in a table, use linear equations to establish any correlations. and use their German to infer and interpret the data (verbally and in writing). Students should then report on their data to the class, formulating conclusions, justifying their results, and explaining any relevant or exceptional circumstances.

Such a statistics-based activity can be tailored to any student group, in any environment. Depending on whether or not the inquiries will be limited to the classroom environment, school building, or community at large, students should be given multiple examples in each scenario to help give them inspiration for their own inquiries.

Students can find sample participants in different ways, such as asking students in other German classes (with instructor permission), creating an online/paper survey to hand out/asking students in the hall, members of clubs, etc. could be suggested.

Encourage students to tie their surveys to their environment with investigations about such things as age/size in plants, age/weight in (domestic) animals, time of day and visual sightings of wildlife, temperature and evidence of insect activity, amount of food (sugar/water/etc.) and number of insects (ants, for example), etc.

Wortschatz

die Zahl
der Bruch
die Kurve
die Skizze
die Daten
die Tabelle
die Form
die graphische Darstellung
die Linie
die Textaufgabe
die Lösung
die Achse
die Gleichung
die lineare Gleichung
die Erklärung
der x-Achsenabschnitt
der y-Achsenabschnitt
der Achsenabschnitt
rechnen

berechnen
lösen
finden
kombinieren
beschreiben
interpretieren
erklären
begründen
erweitern
graphisch darstellen
skizzieren
vergleichen
besonders
steigend
fallend
hoch
tief
steil
passend

flach
geteilt
schön
fertig
richtig
falsch
klar
graphisch
algebraisch
positive Steigung
negative Steigung
befragen
interviewen
zuerst
danach
als nächstes
später
zuletzt
schließlich