Project in Citizenship and Mathematics
Project No. 2017-1-UK01-KA201-036675

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

THE FACE OF A COUNTRY IN FRACTIONS

Exploring land use with mathematics

Description

The students get into the topic of ratios based on the distribution of land use patterns in different countries. Also, the climatic and geographical differences in terms of land use are addressed. They work with data and get to know advantages and disadvantages of simplifications and modelling.

Global citizenship competences addressed

- capacity to examine global issues
- analytical & critical thinking skills
- communication & co-operation skills
- conflict resolution skills

Global citizenship content

Consider the world as a whole; get to know living conditions in different countries; consciously perceive one's own living environment; solve tasks in teams with equal rights

Mathematical approaches

- looking for patterns and connections
- asking yourself questions
- being organised and systematic
- being resilient and flexible
- conjecturing and checking things out
- visualising, imagining and using intuition
- using representation and symbolism
- modelling and dealing with uncertainty
- using argumentation and reasoning
- questioning the use of mathematics in structuring experience of the world

Mathematical content

Estimating, rounding, summarising and simplifying; analysing data; interpreting and comparing proportions and fractions

Resources required

For the whole class: a bag filled with different foods (mango, potato, coffee bean, lentils, olives), a globe, an empty poster, pencils, magnets, coloured paper, chalk

For each student: worksheet with the empty grid (twice)

For each learning group: Statement Cards (choice between two templates), ten country sets (Argentina, Bolivia, Finland, Georgia, India, Ireland, Japan, Kenia), research sheets about Greece, Rumania, Portugal, England and Germany

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Time needed (in and out of the classroom)

Approximately four hours curriculum time (two double lessons)

Organization and practical issues

The class starts the unit in a circle. Later the students work individually and eventually they work in small groups.

Suggested plan for teaching

Task 1: Getting to know different kinds of land use. (approx. 1 hour)

For the introduction of the topic, the students sit in a circle. This ensures that all students have the chance to participate equally at the activity and can easily get in contact with each other. Additionally, a globe, which will be used in the first activity, is positioned in the middle of the circle. Now, a bag filled with different foods is passed around. Ideally, the foods come from different countries. For example a mango (India), a potato (Germany), coffee beans (Kenia), olives (Greece) and lentils (Argentina). The students have to put the foods out of the bag.

What is this? Do you know its name?
Have you ever eaten it?
Do you know where it is grown?

When answering the question about the food's origin, the students are asked to look for the country on the globe and examine what it looks like. One after another, the students will talk about each food out of the bag.

☺+☺ If an eTwinning partnership with one of the partner countries exists, the activity can be extended to get to know the partner class. Therefore, the students choose fruits and vegetables from their own country and present them to the partner class. Can they find food the other class has never tried before?

After the first activity, the class stays seated in a circle. Now the students shall take a closer look at the globe.

What else can be seen on the globe except for the countries' form and position?

The students might mention the different colours on the globe. Possibly, they describe oceans, rivers, ice or mountains which are all marked in different colours.

Which parts of the countries are not marked on the globe? Can you see forests, grasslands, etc.?

This question provides the first step for getting to know the different kinds of land use.

There are different possibilities how to use land. Often they are not marked on the globe. I would like to talk through the biggest and most important classifications.

Therefore, a big poster is laid in the middle of the chair circle to create a "legend" for the different kinds of land use. Later, the poster could be hung up in the classroom so that the

students can look at it while working. The symbols as well as the matching colours for the different kinds should be outlined on the poster in advance. Thus, time is saved and the students get some orientation.

Here you can see the colour brown and a symbol for wheat. Can you imagine which kind of land use this might symbolise?

By using this question technique, all other kinds of land use are clarified. As an explanation, some notes are made on a poster.

The posters could look like this:

		farmland	Cultivation of food
		grassland	meadows for grazing and cutting
		settlements and infrastructure	villages, cities, streets
		forests	trees, natural resources
		Water and wetlands	rivers, lakes, moors
		Other	mountains, deserts, ice, Ödland, snow

The students can copy the legend into their exercise books. However, it would also suffice to have the legend on the poster.

If there should be enough time, the bag could be passed around again, this time filled with different items such as corn, wood, cars or houses. Then, the students could guess which category the items belong to.

Task 2: Working with the 10-piece sets (approx. 1 hour)

Before the start of this phase, the magnet-squares should be prepared. Cut out large squares (preferably 10 cm x 10 cm) of cardboard in the respective colours and provide them with adhesive magnets. However, you can also use normal magnets to pin the squares onto the board. Make sure you have enough squares of each colour to be able to put all sorts of country sets on the board.

The pupils are still in the circle.
To see the different types of land use in the world, imagine the entire landscape of the world would fit on a big rectangle.
For this purpose, a large rectangle is drawn on the blackboard. It is important that the 10 magnetic squares fit on the rectangle (2 x 5 squares). Therefore, it is recommendable to draw the rectangle in advance and open the blackboard at this point of the lesson.

In order to divide the world into its different kinds of land use, we need to divide the rectangle into 10 squares.
For this purpose, 10 magnetic squares are put on the rectangle, for example only coloured in light green.
Now the whole world would be only grassland. In other words, the world is 100% grassland.
Then, one of the squares is exchanged by a blue one.
How big is the part of the grasslands now? Or: How big is the area of water and wetlands?
The students might answer that one out of ten squares is water and wetlands and nine out of ten are grassland. At this point, thematise percent:

If the whole rectangle, that is all 10 squares, was made of grassland and this was 100%, then one square stands for 10%. So, all land in the world now consists of 10% of water and wetlands. What percentage is still available on grassland? - 90%.
Then 4 more light green squares are replaced by 4 blue ones.
Of how much water and wetlands and how much grassland does the world consist now?
The children may say at this point that this is half or 5 out of 10 squares of water and wetlands or grasslands. Tell them that this equals 50%. Keep going on in this manner for a while.
For example: *The world consists of 30% forests and 70% farmland*. The students can fill the rectangle with the fitting squares. Or the teacher puts some squares into the rectangle: *What percentage of forest land is now on the world map?*
During this task, mathematical terms should be used, e.g. proportion, percent, one tenth, etc. This exercise may be performed as previously described. However, variations are possible at any time; for example, you can start with different colours.

After that, the students should put the real land use on the board. For this the students get the following information: 20% forests, 10% farmland, 30% grassland, 40% other.
Take a look at the globe. What is missing on the board?
The teacher explains that 70% of the world's surface is covered in seas and 30% of the world is land. Right now, the class is going to focus on the land area. That is why the whole land area stands for 100%.
Why are there so many violet squares?
Thereby, the proportion of glaciers (11%) and unusable wastelands (19%) should be thematised. On the board they are included in the category "Other". In addition, discuss with the pupils that "Other" also includes the land use types already mentioned, if their share is so small that they cannot fill their own square. Refer to the world set on the board while explaining this.
You can now see the land use of our world on the blackboard. Not all types of land use we talked about can be found. Which types can't you see? - Settlements and infrastructure, water and wetlands.
Can you imagine why these colours do not appear? – Their proportion is too small to fill an own square.
Nevertheless, there are water and wetlands as well as many human settlements on the world. Where are they? – They are summarised in the category "Other".
Whenever in the future some of the types of land use, we have talked about, do not appear as an own square because they are too small, they probably belong to the category "Other". This is very important, as we are going to look at some countries in more detail now.

The students should then copy the distribution of the world into their exercise book. To further consolidate this development, all learners get a worksheet with a 2x5 square grid. The teacher now writes the rounded percentages for the types of land use in the children's home country on the board. Depending on your country, use the data in the box below. The students should colour the squares correctly in individual work, cut them out and lay them in their exercise book. This is then checked by placing the magnetic squares on the board. They glue the right solution in their exercise book.

Germany
→ 30 % farmland, 20 % grassland, 40 % forests, 10 % other

Rumania
→ 30 % farmland, 30% grassland, 30 % forests, 10 % other

Portugal
→ 40 % forests, 10 % farmland, 20 % grassland, 30 % other

England
→ 10 % forests, 20 % farmland, 40 % grassland, 30 % other

Greece
→ 30 % forests, 10 % farmland, 20 % grassland, 40 % other

If there should not be enough time for the last exercise, the students can do it as a homework.

Task 3: Statement-Cards (approx. 1 hour)

At the beginning of this phase, it is important to clarify that the countries have different sizes and that the information relates only to the relationship:
For example, Germany and Portugal are not the same size, but both have the same proportion of forest area in relation to their total area. This does not mean that the forest area of Portugal is just as large as the forest area of Germany.
There are two different variants of this activity. First variant: Bolivia, Finland, Georgia and Kenya. Second variant: Argentina, India, Ireland and Japan. The teacher can choose one of the variations for the children. The other variant could be used for groups that have processed their first variant quickly and completely.
The children split in small groups and receive worksheets with the country sets on the four countries they should work with. These are labelled with the country and below, there is the set of ten for the country. Moreover, the groups receive so-called "statement cards". These cards contain information about the four different countries. Some of the information is correct, some is false. Some statement cards can't be identified as true or false without some additional research, as the country sets do not contain enough information. The teacher can choose a number of cards that fits the amount of time and the number of students per group. There should be about the same number of "yes", "no" and "we do not know"-cards. Each student receives a number of cards (two per person are recommended) and is not allowed to show the cards to the others during the whole activity. First, the children read their cards to their group one at a time in as many rounds as it takes to read out

all cards. They have to listen to each other very carefully and have to try to remember the information. In this first round, the statements must not be commented on and no questions asked. This should foster the students' ability to listen to each other. They should value each other's contribution and be able to work together as a group in which each member has a special role. Afterwards, there is a second round in which the cards are read out again. This time questions may be asked, and statements commented. The children sort the cards in a "yes", "no" and "we do not know" pile. The groups can do some research about the statements on the "we do not know" pile. Fast groups can also receive the second variant for differentiation. To control this activity, solutions are put on the teacher's desk. The students are only allowed to check their answers, if they have finished the exercise. Later, the class can talk about difficulties and problems which occurred during the task. In this activity, the children learn to make logic conclusions and learn to decide which statements they can verify with the information they possess, and which not. They gain some experience and self-efficacy in working with temporary uncertainties ("we do not know" pile).

Task 4: Create your own country set (around 1 hour)

Four new small groups are formed and each group gets a different research sheet with information about one of the partner countries (without the native country. Based on the information on the research sheet, the students should create their own set of 10 squares. On the sheet there are pie charts with per cents, information about the land area, the number of inhabitants and texts with information. It is important to notice that not all facts and background information are needed for the exercise. Some of the information about the types of land use are divided into smaller or larger categories than the students need. It is the students' job to put them into useful categories, for example by deciding where they want to place permanent crops. In addition, the children must round the numbers include very small entries e.g. water and wetlands or farmland into "Other". There will often be no optimal solution. Pupils should be aware of the benefits of this simplification (focus on the essentials, clarity), especially when they realise during their work that simplification means that information becomes inaccurate or is lost completely. They have to make their own decisions, which categories they summarise, whether they need an "Other" category and what is included in it. Remind the students that they're going to be asked to explain their decisions later. They should write down exactly what they have summarised or rounded for what reasons. In the following round of introductions with the aid of the magnetic squares on the board, the children should present their decisions and the corresponding reasons. For differentiation, groups that finish quickly can work on other partner countries.

At the end of this unit, the students should compare their results. Therefore, they should take some notes about the other groups' strategies during the presentation. Afterwards, the plenum tries to identify similarities and differences in what the groups did. In doing so, the following questions should be raised and answered: *What did we summarise? What was rounded? Are there any good arguments for the strategy of a particular group? If we could start the activity again from the beginning, would we do anything different? Why? Is it possible to compare the countries with each other with our country sets, as it was possible with the statement cards? Why/why not? Has everyone decided on the same/similar categories?*

☺+☺ Maybe children from different countries could work on this activity together by using eTwinning. If logistic reasons make this difficult, at least the results as well as arguments for different strategies could be exchanged.

The country sets we have looked at before have been created by using the same criteria. That is why they can be directly compared.
Again, the children take a look at the country sets, the statement cards and the drawing of the country set of their native country in their exercise book.
Start with asking the children questions that are similar to the statement cards. Everything that was previously developed with the country sets can be recapitulated here.
After a while, transfer tasks can be added: For example: *In which country is the most land used for food production?* (Here you have to add farmland and grassland.) *Japan and Argentina both have one box for farmland. Does that mean they both harvest the same amount (or kind) of food?*
Recapitulate what can be read out of the boxes and what not, e.g. the quality of the farmland, the biodiversity of the forests, the favourable or unfavourable climatic conditions, etc.
Finally, the children themselves are encouraged to ask each other similar questions and to reflect together on whether they can answer them by their country sets or by additional research.

Extending the learning

If there is sufficient time to conduct a P4C enquiry with the children, the final benchmarking activity of comparing the countries may be placed at the beginning of a fifth hour. In the course of this, identify questions that the children find particularly intriguing.

The understanding of land use is also the basis for many global issues such as erosion, desertification, global food and hunger, and many more. This unit could thus be followed by related learning units.

Other resources (material and human resources)

If the children want to do some research on their own, the source https://knoema.com/atlas is recommended (especially in respect of eTwinning) because it is available in different languages. Thus, all students can work on the same basis.

Ethical issues or dilemmas

We are used to look for differences in quality when doing comparisons. However, it should be avoided to link farmland, for example, with “good” and barren land with “bad”. (With reference to ecological value, it is often the other way round).

It is even more important not to classify a whole country as good or bad because of the fact that it has more or less of a particular kind of land use. Still, the children should learn that environmental conditions may be a challenge for people in different countries. Europeans are privileged because of the favourable environmental conditions in Europe. The field of tension which originates out of these challenges should be handled sensitively.