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In this teacher material you will find the following

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1) Introduction

This is your own personal guide to the world of Kitsat and the course concerning environmental studies.

Start your journey by reading through sections 2 and 3 (the table of contents, topics of this course and the main learning goals of this course). Next make your way to the section number 4, "How to set up and execute the course".

Make sure you have printed out the printables needed during the course. These printables include the information sheets for students and other printable materials that you and the students are going to need during the course. You will find these printables attached to the other course material provided.

If you want the students to go through the course at their own pace print out the printable version of the course and have it ready as you start the course. You will find the printable version of the course attached to the other course materials provided.

Now it is time to start the course. Section 5 is the walkthrough of the game. This section will tell you what to do in different stages of the course and game and what the students will do and how. This section is your guideline on how to implement the course. This section also includes the correct answers to each assignment and task the students will face during the course.

2) The main topics of this course are:

- Weather
- Climate
- Traffic and safety

3) The main learning goals of this course

- Students gets a basic understanding of the topics listed above
- Student knows how to observe ones own close by neighbourhood
- Students are able to utilize the Kitsat satellite and its features and sensors
- Students practice working as a team

The main 21st century skill goals of this course are:

- Thinking and learning to learn skills
- Participation, involvement and building a sustainable future
- Cultural competence, interaction and expression
- Multiliteracy
- Taking care of oneself and managing daily life
- ICT competence

4) How to set up and execute the course

Topics listed above are divided into lessons. Each lesson's minimum duration is 45 minutes. Duration of the lesson can vary depending on the topic. And also you as a teacher can decide if you want to go deeper into some of the topics listed above.

Course is built on a story which continues towards the end as students solve problems, tasks and assignments. Assignments are done by searching, reading and applying knowledge they have acquired. And also by using the features and sensors of the Kitsat. Information can be found in the information material provided with the course or you can use different kinds of information sources during this course.

The following colours in the course's slideshow indicates when it's time to do an assignment, read information from the students' information material or when to give students a badge. The colours are the following:

Violet colour indicates an assignment. More detailed information is provided about the assignment in the assignment itself and at the section 4 of this material (The walkthrough of this game)

Grey colour indicates the time when students should look for information from the informational material provided. In the game this information material is called G.A.S.P.

Yellow colour indicates when it's time to assess the students progress. And to decide what their badge's value after completing an assignment is. You will find more information about this assessment tool below. Yellow colour also indicates that it's time to give the students a piece of the planets name and coordinate that they are trying to solve.

The course can be taught by the lead of the teacher or the teacher can share the course with students so that they can progress at their own pace. You are free to choose how you will approach the course.

5) Assessment of the course

The course assessment is done by giving the students different kinds of badges as they complete an assignment. There are three levels of badges: Gold, silver and bronze. Each badge represents a certain range of grades.

Gold: Grades 10-9

Silver: Grades 8-7

Bronze: Grades 6-5

Grade ranges include the plusses, minuses and halves of each grade. Students goal is to gather nine badges. And each badge represents a certain grade that is decided by the teacher based on how well and thorough the student has completed a certain assignment. The final grade of this course is determined by the arithmetic mean of each grade.

For example a student has 5 golden badges, 3 silver badges and 1 bronze badge. This particular student's grades are the following:

5 x 9+ (The golden badges)

3 x 8+ (The silver badges)

1 x 6,5 (The bronze badge)

$$\begin{aligned} &5 \times 9,25 + 3 \times 8,25 + 6,5 \\ &= 46,25 + 24,75 + 6,5 = 77,5 \end{aligned}$$

$77,5 : 9 = 8,61 \leftarrow$ This is the final grade of the course. Which would mean 8,5 so $8\frac{1}{2}$ as the final grade.

The badges can be printed out and handed to students after each assignment. You can choose how your class will present the finalized assignments. Will they be presented and shared orally, handed to the teacher or gathered to some digital platform. Also the way the students answer to the assignments is up to you to decide. You can use paper and pen, computers, laptops, mobile phones or any other way you feel comfortable with.

The badges can be then clued on the character sheet that the students fill out at the start of the game. You will find the badges amongst other printables attached to the material provided.

6) Implementation of the course

Present the students with the course's main topics and main learning goals. Have the students discuss the learning goals. You can help them out with the following question to guide their discussion.

- What do you think is the most important topic of this course?
- What do you think is the most important learning goal of this course?
- What topics are you most interested in?
- What topics of this course do you already know something about?
- What topics are completely new to you?

Have a discussion about what the students think about the topics and learning goals of this course.

After the discussions you can divide the students into groups. Divide the groups so that each group gets a satellite. How you divide the groups is up to you to decide. So the number of groups is the same as the number of satellites you have.

Open the Kitsat environmental studies student version on your computer and project it on a screen. You can also print out the student version of the course and hand it out to the students.

Start by reading the story at the beginning of the student version (slide 2). You can read the story yourself or let the students read it by themselves. If you read the story yourself it is good to read it enthusiastically.

Continue with the story until you reach slide number 8. This is the first assignment. In this assignment the students will create a character so that it's easier to emphasize with the story and the game. The students can fill out a character sheet that is among other printable materials of this

course. After the students have finished the assignment it's time to introduce their characters to others.

After the introduction it's time to get to know the Kitsat satellite. In the next assignment the students will make remarks about the satellite and its basic appearance and features.

Correct answer to the questions at ASSIGNMENT 1 are:

- ***The Kitsat satellite consists at least of the following materials: plastic, metal, silicon, copper, tin, glass, nickel, cobalt, lithium and carbon fibre.***
- ***The Kitsat satellite is a cube satellite. So it is a shape of a cube.***
- ***The cube shape of the satellite is the reason that every dimension is the same. Dimensions are 10 cm, 10 cm and 10 cm.***
- ***The weight of the satellite is approximately 700 grams***

Now it's time to give students badges. In this assignment it's good to focus on the creativity in making the character and how students express themselves when they introduce their characters. It's also useful to take account of how the groups examined their satellites and give a badge reflecting on how they succeeded in these categories.

Continue the story until you reach slide number 11. It's time for another assignment. In this assignment the students get to know the basic features and sensors of the Kitsat satellite. They will also be made acquainted with their information sheet. This information sheet in the game is called G.A.S.P.

Correct answers to questions at ASSIGNMENT 2 are:

- ***The Kitsat satellite has the following features: camera, on-board computer, electrical power system and battery, radio, antennae and solar panels. The satellite also has the following sensors. GPS tracker, accelerometers, attitude sensors, magnetometer and thermometers.***

After the assignment is completed it's time to give students badges. It's good to take into account the following. What reasons the groups presented in their choice of different topics and how many different features and sensors they managed to find out.

Continue the story until you reach slide number 13.

In this assignment the students have to come up with an explanation on what climate change is and why it is happening. They have the opportunity to consult their information material and come up with an answer.

Example of a correct answer to ASSIGNMENT 3 is:

Climate change is a long-time alteration in Earth's climate and weather patterns. Global warming is part of climate change and it's happening because of the increase of greenhouse gases (such as CO₂) in the atmosphere. These greenhouse gases are being produced over hundreds of years by industry, traffic and farming livestock.

In the other part of the assignment the students will use the Kitsat satellite and its IR (infrared) filter to see that in the infrared light the plants outside are “glowing”. This is because the plants are producing energy by photosynthesis. The plants use the energy they produce to grow and to survive in the existing environment. In the photosynthesis the plants need carbon dioxide from the air. And regarding climate change and global warming the plants act as a vacuum of carbon dioxide. In the process of photosynthesis this carbon dioxide is being transformed into oxygen. Thus every plant that uses photosynthesis has a positive impact on the environment because they eat up carbon dioxide from the air.

In the assessment part of this assignment, when giving the badges, it's useful to take into account how well the students have explained the concept of climate change and how they have answered the questions related to the part of assignment where they are utilizing the satellite.

Now continue the story onwards until you reach slide number 16.

In this assignment the students must explain why and how plants have a positive effect on the climate.

EXAMPLE OF A CORRECT ANSWER IN ASSIGNMENT 4:

Green plants are producing energy by photosynthesis. The plants use the energy they produce to grow and to survive in the existing environment. In the photosynthesis the plants need carbon dioxide from the air. And regarding climate change and global warming the plants act as a vacuum of carbon dioxide. In the process of photosynthesis this carbon dioxide is being transformed into oxygen. Thus every plant that uses photosynthesis has a positive impact on the environment because they eat up carbon dioxide from the air.

Next the students have to come up with different kinds of other solutions that could have a positive impact on the climate.

EXAMPLE OF A CORRECT ANSWER IN ASSIGNMENT 4:

Renewable energy, recycling, circular economy and public transportation. For example.

In the next part the students have to explain how satellites might be used to tackle climate change.

EXAMPLE OF A CORRECT ANSWER IN ASSIGNMENT 4:

Satellites have continuously observed the Earth over the past five decades to the present day. This information helps scientists to chart the evolution for the key components of the climate, better understand Earth system processes, predict future change and drive international action. Also they can monitor the concentration of greenhouse gases in the atmosphere.

When giving the students badges from this assignment take account of how well they have explained the questions in hand.

Continue the story until you reach slide number 19.

In this assignment the students will search for information from their information sheet regarding weather. After going through the information provided they need to answer the questions in the assignment.

EXAMPLES OF CORRECT ANSWERS IN ASSIGNMENT 5:

- ***Climate is the typical weather conditions in an entire region for a very long time. Thus weather is only temporary and it can change many times in a day.***
- ***Many factors combine to influence weather but the four main ones are solar radiation, the amount of which changes with Earth's tilt, orbital distance from the sun and latitude, temperature, air pressure and the abundance of water.***
- ***Many factors, such as elevation, ocean currents, distance from the sea, and prevailing winds, can affect the climate of an area. The latitude of an area indicates how far it is north or south of the equator. Latitude affects climate because it is related to the length and intensity of sunlight an area receives.***
- ***You can make observations on cloudiness, whether it's raining or not, if it's windy or not and also you can tell something about the temperature by looking at how people are dressed.***

When giving the students badges from this assignment take account of how well they have explained the questions in hand and how good were their observations of weather outside. And also how they managed the part of the exercise where they had to utilize the Kitsat satellite.

Now continue the story until you reach slide number 22. This assignment is about climate diagrams. First the students have to explain what a climate diagram is. After that they will interpret the diagrams that are found in this guide amongst other printable materials. Next the students need to think about how satellites are being utilized in making climate diagrams. In the last part of this assignment the students get to use their creativity in solving the problems of harsh weather conditions around Lavonia.

EXAMPLES OF CORRECT ANSWERS IN ASSIGNMENT 6:

- **A climate diagram displays yearly temperature and precipitation statistics for a particular location. Temperature is measured using the numbers on the left hand side of the diagram. The average temperature for each month is plotted on the diagram with a red dot and the dots are then connected with a red line. Precipitation is measured using the numbers on the right hand side of the diagram. The average rainfall for each month is plotted on the diagram with a blue bar.**
- **First diagram is from Bangkok**
- **Second diagram is from Irkutsk**
- **Third diagram is from Sydney**
- **Satellites have continuously observed the Earth over the past five decades to the present day. This information helps scientists to chart the evolution for the key components of the climate, better understand Earth system processes, predict future change and drive international action.**

In the assessment part of this assignment it is important to notice how well the students have explained their answers and what kind of creative solutions they have come up with. And of course it's good to observe how well and equally the group of students are working together.

It's time to move on. Continue the story to slide number 26. In this slide you'll find an extra assignment that has no right or wrong answers. You can decide if you want your students to do the extra assignment or not.

Next continue the story until you reach slide number 28.

In this slide the students will observe traffic near the school. They will observe different kinds of vehicles and transportation. They will also do a traffic census. Traffic census can be done following the instructions below:

First print out the graph from the printables section. Then decide a spot where the students will carry out the traffic count. Then decide how long the students will observe traffic (5 minutes, 10 minutes, 15 minutes etc.). Students can share different vehicles and types of transportation within their groups so the count is easier to carry out. When the observation is done the amount of each type of vehicle and type of transportation is coloured in the printable graph. After this is good to review the results together and make some conclusions about the traffic the students observed.

Next the students will think about how they could use the Kitsat satellite to carry out a traffic count. What features and sensors would be beneficial to use in the traffic count?

To conclude this assignment the students need to innovate a way to make the traffic near the school more environmentally friendly and fluid.

When assessing the assignment it's important to take into account how well the group managed with the traffic count and what kinds of ideas they had using the Kitsat satellite in the traffic count. It's also important to notice what kinds of innovative solutions the students came up with to develop the traffic near the school.

Next continue the story until you reach slide number 31.

Assignment number 8 is about traffic safety. There are clear instructions to the students written to the assignment itself. Here are the same instructions to the student groups.

Divide into two groups. Other groups stays with the Kitsat ground station and computer. And the other group takes the Kitsat satellite outside.

The group going outside has to map out traffic's dangerous or unsafe places near your location. Remember to try to place the satellite somewhere high up if possible.

The group inside takes a photo of the place by commanding the satellite's camera. You can also try to take a panoramic shot of the place that you have found out.

Make sure to find out at least three places.

After the mapping out come up with solutions that could make the mapped out places safer in terms of traffic.

EXAMPLE ANSWER TO ASSIGNMENT 8:

Traffic satellites will lead to better information about traffic, particularly if combined with route planners and navigation systems. They make route choices easier. They help you to choose the right public transport. They help you to avoid traffic jams and as a pedestrian, it can tell you the safest road.

When assessing this assignment take notice on how the students managed to utilize the satellite and what kinds of ideas they had on making their observed places of traffic safer. It's also important to assess how the group worked together.

Now continue the story until you reach slide number 35.

This is the last assignment of the game. In this assignment the students will utilize the Kitsat satellite to map out unpleasant, uncomfortable and dangerous places near the school. After the mapping out they have to innovate ways to make the mapped out places safer, more pleasant and more comfortable. In this part of the assignment the students can let their imagination run wild.

When assessing the last assignment pay close attention on how the group works together and how they make compromises when innovating. Also take into account how well the group managed to accomplish the mapping out with their satellite.

Continue the story to the end of the slideshow.



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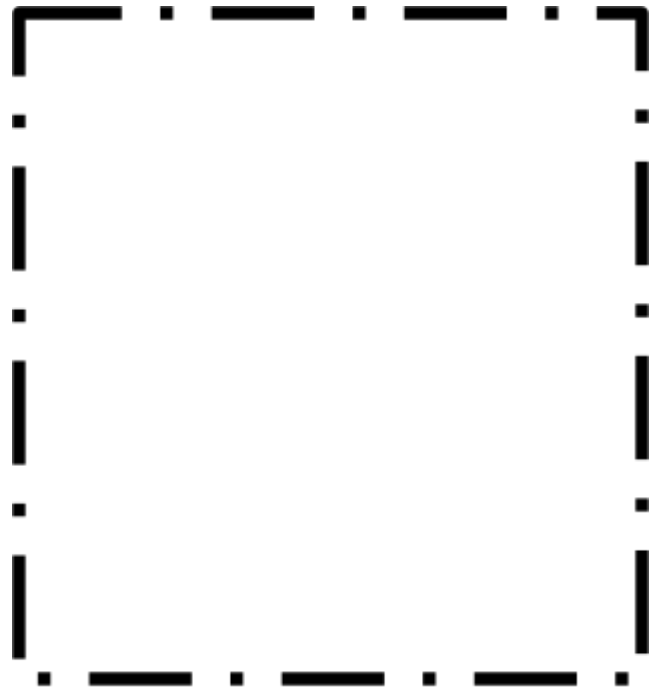
Age:

Family:

Personality traits:

Points of interest:

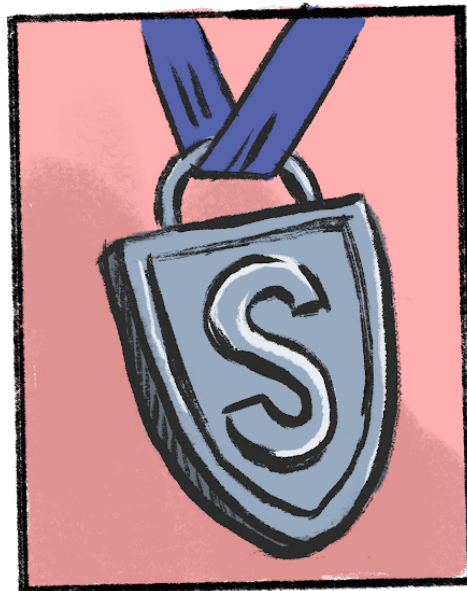
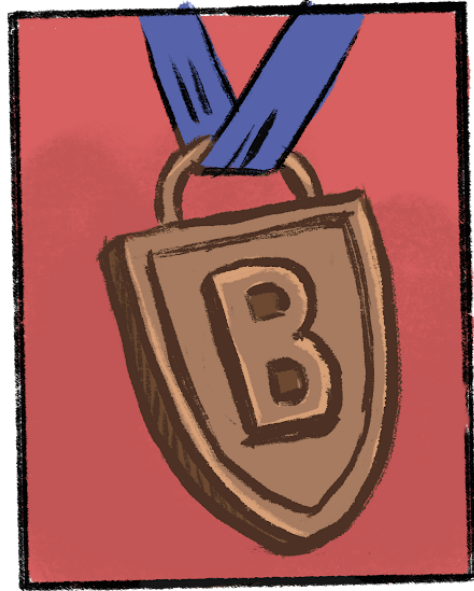
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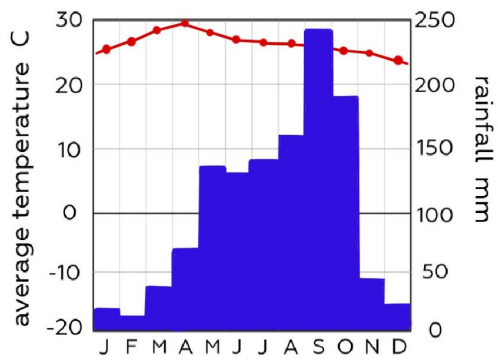


Facial scan for recognition

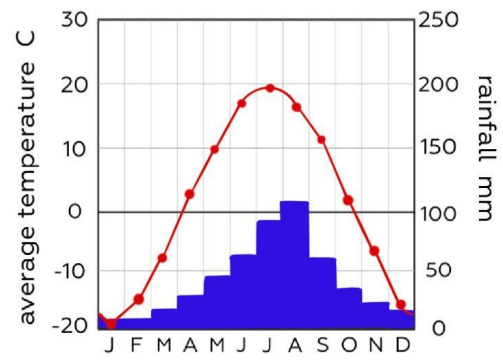


BADGES EARNED

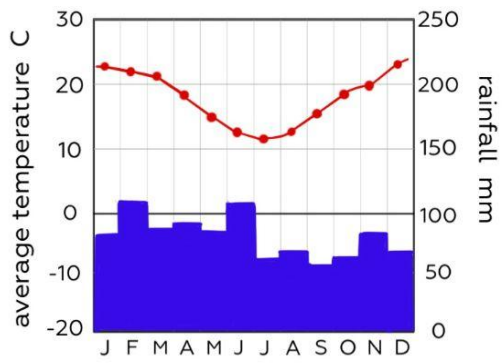




Bangkok



Irkutsk



Sydney

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| TYPES OF TRANSPORTATION | Cars | Trucks and other big cars | Motorcycles, mopeds and scooters | Pedestrians | Bicycles |