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| ACTIVITY PLAN | | |
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| **Theme** | **Subtopic** | **Activity Title** |
| 5. Global and Local Perspectives in Environmental Education | 5.3. Cultural and Social Dimensions of Environmental Issues | How clean are your hands? |

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| Introduction part (or activity overview) |
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| **Introduction part (or activity overview)** | Students read and discuss bacteria, hand sanitizers, skin epidermal layer and its properties.  [**https://www.britannica.com/science/bacteria**](https://www.britannica.com/science/bacteria)  [**https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html**](https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html)  [**https://microbewiki.kenyon.edu/index.php/Human\_Hands\_and\_Fingernails**](https://microbewiki.kenyon.edu/index.php/Human_Hands_and_Fingernails) |
| **SETTING** | A lab/ Chemistry classroom or at home |

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| Materials Needed |
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| **Materials Needed** | Petri dishes (with lid), ¼ cup of Water, 1 teaspoon of sugar, Sticky tape, 1 teaspoon of gelatin  Pan for boiling, Spoon, Hand Sanitiser |

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| **Learning Outcomes** | To create a suitable environment for the microbes to grow and then observe them, learn about importance of personal hygiene. |
| **Activity Contents** | **Activity 1: Discussion of personal hygiene (Duration: 15 minutes)**  **Theoretical part:**  Introduction discussion: (10 minutes)  The teacher introduces the students to the causes of diseases, and then plays a short video.  Students discuss about the emphasis in today’s world to keep our hands clean, to maintain personal hygiene, use of hand sanitizers, the presence of microbes and bacteria in our everyday life. They watch a video of the expirement:  <https://www.youtube.com/watch?v=nArV1eHM-3g&t=2s> (Duration: 2:05 minutes)  **Activity 2: Realization of an experiment (Duration: 80 minutes)**  **The teacher introduces them to the steps of making the experiment**  Step 1: Boil the water in a pan.  Step 2: Add the gelatin powder to the water until all of the gelatin has dissolved.  Step 3: Whilst still hot, pour the gelatin into the petri dish until it is around ⅓ full. Repeat for the other petri dish.  Step 4: Place in the fridge, with the lid on, for around 12 hours, until the gelatin solidifies.  Step 5: Remove from the fridge and then slightly press your thumb on the gelatin and place the lid back on. For safety reasons, seal the containers tightly with the sticky tape. Label the petri dishes with the date and mention in which petri dish the hand sanitizer was utilized.  Step 6: Rub your hands with the hand sanitizer and repeat step 5 using your ‘clean’ hand.  Step 7: Leave for a few days (around 3-7 days) in a dark room at room temperature until multiple spots appear on the gelatin. These are the bacterial colonies.  Step 8: If you happen to have a compound or stereo microscope, try looking at the different bacterial colonies up close.  Step 9: Observe whether the hand sanitizer has reduced the number of bacterial colonies present on your hand.  Students conduct the experiment according to the teacher's instructions, and then discuss the results obtained.  **Activity 3: Discussion (Duration: 20 min.)**  The teacher discusses and analyzes connected topics: personal hygiene, use of hand sanitizers, the presence of microbes and bacteria in our everyday life.  Students discuss what they witnessed, what they produced, how was it achieved.  **Example questions (reflection):**  ***What are bacteria?*** Single celled prokaryotes which have membrane bound nucleus.  ***Why is gelatin used as a culture medium?*** Contains nitrogen and carbon compounds necessary for bacterial growth.  ***What is the effect of the hand sanitizer on bacterial growth?*** Inhibits bacterial growth.  ***What is a common bacterium that is present on the hand?*** Staphylococcus epidermidis.  ***What is a more efficient method of cleaning hands rather than using hand sanitizer?*** Wash hands with soap and water.  **Additional tips, Homework:**  Try using different non-toxic chemicals on your hand before conducting the experiment to see what is the most effective at killing bacteria. You might want to test if lemon juice has the ability to kill bacteria or maybe even white vinegar.  Are you interested in knowing how dirty your house truly is? Then why not repeat the experiment but this time taking swabs of different areas of the house such as perhaps your bed or the toilet seat.  We keep food in our fridge to prevent it from spoiling. Show the effectiveness of cold in controlling microbial growth by repeating the experiment but this time placing the Petri dishes in the fridge. Compare the results obtained with the bacterial growth at room temperature and see if the fridge does reduce the rate of bacterial growth. |
| **Assessments** | The final result is evaluated with a grade.  All students in the class can be included in the evaluation.  Each student independently evaluates his contribution to the work.  Students can compete for a correctly conducted experiment. During the assessment, the following are taken into account: The speed of work and correct implementation of all steps of the experiment. |
| **Key Competences** | Communication competence  Cognitive competence  Competence for creativity  Artistic competence |
| **Connections with Eco STEAM** | **Eco** - Clean hands.  **S**ience - knowledge of chemistry, biology and mathematics; environmental sciences – fostering sustainability thinking.  **T**echnology - using a computer in the research process, microscope, digitrons for calculation  **E**ngineering - determining the most effective hand sanitizer  **A**rt - making gelatin.  **M**athematics - calculation of the number of bacteria after their reproduction, calculation of costs for the process of examining the presence of bacteria. |
| **References** | <https://www.youtube.com/watch?v=nArV1eHM-3g&t=2s>  <https://www.britannica.com/science/bacteria>  <https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html>  <https://microbewiki.kenyon.edu/index.php/Human_Hands_and_Fingernails>  <http://www.livescience.com/51641-bacteria.html>  <http://www.sciencebuddies.org/science-fair-projects/project_ideas/MicroBio_Agar.shtml>  <https://www.cdc.gov/handwashing/show-me-the-science-hand-sanitizer.html>  [**https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html**](https://www.cdc.gov/infectioncontrol/guidelines/disinfection/index.html)  [**https://en.wikipedia.org/wiki/Staphylococcus\_epidermidis**](https://en.wikipedia.org/wiki/Staphylococcus_epidermidis)  [**https://courses.lumenlearning.com/microbiology/chapter/mycoses-of-the-skin/**](https://courses.lumenlearning.com/microbiology/chapter/mycoses-of-the-skin/) |
| **Notes** | / |

**Assessment Table for individual work:**

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| Evaluation Criteria | Points | Comments |
| Understanding which bacteria live on the hands | \_\_/5 |  |
| Understanding what personal hygiene is | \_\_/5 |  |
| Understanding what a more efficient method of cleaning hands is | \_\_/5 |  |
| Communication competence | \_\_/5 |  |
| Cognitive competence | \_\_/5 |  |
| Competence for creativity | \_\_/5 |  |
| Answered questions correctly | \_\_/10 |  |
| Completed homework | \_\_/10 |  |

**Assessment Table for group work:**

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| Assessment Criteria | Points | Comments |
| Internet research skills | \_\_/5 |  |
| Production of quality gelatin | \_\_/10 |  |
| Calculation of cost price | \_\_/5 |  |
| Ecological Interpretations in the project | \_\_/5 |  |
| Teamwork and Collaboration | \_\_/5 |  |
| Skills of presenting the work | \_\_/5 |  |