TEMPLATE for BEST PRACTICE EXAMPLES

1. **Name of the project:**
   DIY Flashlight

2. **Subjects covered from STEAM areas:**
   Science, Engineering, Art, Mathematics

3. **Target group (age range and size of the group):**
   11-16 years old

4. **Duration of the activity:**
   1 hour

5. **Keywords:**
   electricity, illuminance, luminous flux

6. **Key sentence describing context of the activity, followed by short description (200 words):**
   Students make their own flashlight from simple materials, measure the illuminance and calculate the luminous flux of the flashlight.

   Students are given only a limited amount of materials to construct a flashlight of their own. The flashlight must look and work like a real flashlight. The task is to construct a flashlight that has as high illuminance as possible. After measuring the illuminance of the flashlight, the students calculate the theoretical luminous flux of the flashlight.

7. **Description of the activity environment, including the list of materials and tools needed:**
   Environment: classroom
   Materials and tools:
   - three batteries (e.g. AA, C or D size)
   - three light bulbs
   - paper
   - conductive wire
   - aluminum foil
   - Scotch tape
   - illuminance meter

8. **Step by step, detailed description of the activity, including teaching and learning strategies:**
   Students should already know the basics of electricity and the concepts of series and parallel connections.
   Students are divided into groups.

1. Trial and error phase, how to make the light bulb illuminate?
   Students are tasked to first get the light bulb illuminate with the materials given. When the light bulb is illuminating, the students are tasked to get the light bulb to illuminate as brightly as possible. After this the final phase is to get all three light bulbs to illuminate as brightly as possible.
2. Teacher intervention
   Teacher reminds the students about the fact they hopefully found themselves; voltage is highest when the batteries are connected in series, and electrical current is highest when the light bulbs are connected in parallel.
3. Constructing the flash light
   Students are tasked to build a flashlight that looks and works like a flashlight, and which illuminates as brightly as possible in the direction where it is pointed. The students should try to find the solution with minimal aid from the teacher.
4. Measuring the illuminance
   Using an illuminance meter, the students measure the amount of lux their flashlight produces at a given distance (e.g. 1 meter from the flashlight).
5. Calculating the luminous flux
   Teacher teaches how to calculate the theoretical luminous flux from the measured illuminance. Students calculate the theoretical luminous flux of their own flashlight. The results of the groups are compared to each other. Theoretically each of the groups should have the same luminous flux, so the differences in results probably tells more about the ability of the flashlight to direct the light to the desired direction.

9. Learning objectives/competencies:

Applying electricity concepts to practice, manufacturing a well working product, learning the difference between illuminance and luminous flux

10. Evaluation/Assessment guidelines:

If evaluated, the final grade should be a combination of the practical and artistical sides of the work.

11. Lessons learned:

Students are prone to short circuiting at first. The burnt fingers quickly teach the meaning of a short circuit. Students should not be guided too much to really dig out the creative solutions.

12. Additional information/Links:

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13. Contact person:

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