# TEMPLATE for BEST PRACTICE EXAMPLES

1. **Name of the project:**
   Physical computing to research pollution

2. **Subjects covered from STEAM areas:**
   Programming
   Electronics
   Electrical engineering
   Mathematics
   Chemistry
   Ecology
   Arts

3. **Target group (age range and size of the group):**
   For high school - from 12 to 18 years, group of 5 students

4. **Duration of the activity:**
   a) Introduction to the problems and consequences of air pollution
   b) One workshop for connecting all electronic components
   c) One programming workshop
   d) One workshop to present the results
   e) Workshop for working on a 3D printer in order to make protective housing
   f) Workshop for aesthetic appearance of the device

   Each activity lasts 90 minutes. Preparation for each activity takes 90 minutes.

5. **Key words:**
   Electronics, programming, ecology

6. **Key sentence describing context of the activity, followed by short description (200 words):**
   This is a learning activity in which students will acquire knowledge and skills in electronics and programming and form their own device that will indicate the current state of the air, the impact and damage to human health and the environment.

   This project enables students to practice and apply learned skills in the fields of chemistry, electronics and programming while solving problems and making decisions based on their own knowledge, creativity and imagination.
   The project is designed to encourage students to create a device for measuring air pollution and develop awareness of the importance of environmental protection. As students create, they also learn important environmental concepts that will help

them throughout their lives. The project aims to focus on ecology, but there are so many other elements of learning that include inquiry-based learning, problem solving, collaboration, communication, self-directed learning and more.
This project does not focus only on programming and electronics skills, as there are also components of social studies (quality of life), environmental protection, sustainability research, problem solving and understanding skills.

7. **Description of the activity environment, including the list of materials and tools needed:**

Formal activities are performed in school, in classrooms, where students practice their knowledge of electronics, programming. Also, evaluation activities were conducted in the school environment.

Resources required:
- computer with internet access
- Arduino uno
- sensors
- screen
- wire and jumper
- housing
- styrofoam
- paint

8. **Step by step, detailed description of the activity, including teaching and learning strategies:**

- Students have a dialogue with the teacher and with each other about the application of previously learned concepts in chemistry about the composition of air and what can be harmful in it, for human health and the environment
- Students participate in workshops and learn about the formation of output devices that will present the measurement results
- Students make a list of electronic components that will be used in measurement (sensors)
- Students learn how to program microcontrollers to control output devices based on information they receive from sensors
- Students assemble housing, holder and device protection (3D printer printing)
- Students create the aesthetic appearance of the device (Easter Bunny)
- Students give suggestions for further research on the topic

During this scenario, students will explore:
- chemistry (environmental chemistry, types of pollution, air pollution)
- electronics (sensor types and principle of sensor operation)
- aesthetic value of presenting the results and appearance of the device

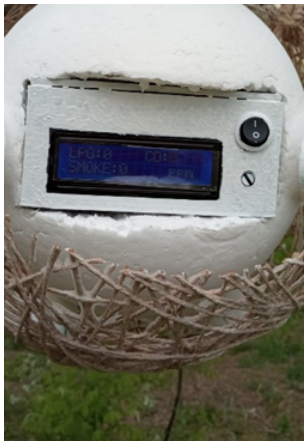
9. **Learning objectives/competencies:**
   This workshop describes how to explore ecology through practical activities. The described activities can be used to connect ecology with mathematics, physics, chemistry, programming, electronics and art. Workshops could be realized in regular school classes as a project.

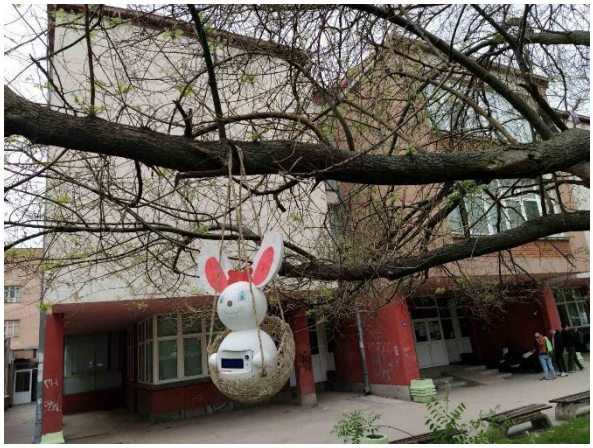
   Domain-specific goals are learning about:
   Environmental chemistry
   Sensors
   Visual effects
   Symmetry
   Proportions

10. **Evaluation/Assessment guidelines:**
    Evaluation is done through informal feedback from students and through formal assessment by the teacher

11. **Lessons learned:**
    Students will be able to create their own physical computer system for measuring different types of air pollution (SMOKE (ppm), CO (ppm), LPG (ppm)) in the school yard on weekdays and weekends. They will investigate changes in both types of days, find and report correlations. Students incorporate knowledge from chemistry / biology / mathematics / electronics / programming / art classes.

12. **Additional information/Links**



**13. Contact person:**

Predrag Šubarević