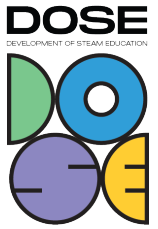


## TEMPLATE for BEST PRACTICE EXAMPLES - SOLVED TASK



1. Name of the task: "Tonoscope".
2. Why did you choose this task?  
This year 10th grade students learned about vibrations and various waves in physics lessons. Students were curious to find out if they would be able to create at least one image on the tonoscope using secondary raw materials.
3. Subjects covered from STEAM areas:  
Math Jurgita Norvilienė  
Physics Virginija Vaičiukynienė  
Music Aistė Juškaitė  
Non-formal education club "Arduino platform in Robotics With Mblock" Jurgita Norvilienė
4. Target group (age range and size of the group):  
The project was completed by group of four 10th grade students (16 year olds).
5. Duration of the activity:  
Music (1 lesson)  
Mathematics (1 lesson)  
Physics (2 lessons)  
Non-formal education group "Arduino platform in robotics with Mblock" 2 lessons.
6. Key words:  
Tonoscope, programming, note frequency, sound wave.
7. Key sentence describing context of the activity, followed by short description (200 words):  
The goal. Investigate the propagation of sound in different materials.  
Tasks. Using secondary raw materials, create a programmable tonoscope on the Arduino platform. Write a program that plays scores in alphabetical names within the specified range. Perform tests with couscous, salt and water. Summarize the results.
8. Description of the activity environment, including the list of materials and tools needed:  
Objects used to build the tonoscope: a metal candy box; a plastic container; a speaker; some cardboard; Arduino Uno; a transistor; a resistance; wires; Bluetooth HC-05 module.  
Activities took place in subject classes, in the laboratory of creative workshops. Some of the activities were carried out by students at home.
9. Step by step, detailed description of the activity, including teaching and learning strategies:  
Students repeated the letters of the music, got acquainted with the concept of sound and, using tablets, found, tested and selected a website where you could listen to different ranges of sounds.

## TEMPLATE for BEST PRACTICE EXAMPLES - SOLVED TASK

In the math lesson students found centers for a candy box and a plastic cup. They were bolted together. A circle was cut out of cardboard for the diaphragm of the speaker, in which he drew the outline in which the cup with the box was to be built.

In the physics lesson, the students connected an electrical circuit that would propagate sound from the speaker.

During the activities of the non-formal education club "Arduino Platform in Robotics with Mblock", the students noticed that the sound was not sufficient during the testing of the program, so they added a transistor to the electronic circuit. It has also been observed that testing sounds in different ranges is very time consuming, so the circuit has been supplemented with a wireless module and the program has been improved. Pupils conducted tests with 3 materials at home and presented the recorded results in class. Students used the canva.com tool to describe the process, results, and conclusions. Research-based learning was applied.

### 10. Learning objectives/competencies:

The theme of the music lesson is "Music Sound Features". Tasks:

1. Remember the letter names of the notes and get acquainted with the concept of range.
2. Find a website on the Internet where you can listen to different ranges of sounds.

The topic of the physics lesson is Sound Wave. Tasks:

1. Connect the electrical circuit to the tonoscope.
2. Perform tonoscope tests on three different materials at variable frequency.

Mathematics lesson "Lines and planes of spatial figures".

1. Set the center of the candy box.
2. Apply geometry knowledge to center the box on the speaker diaphragm.

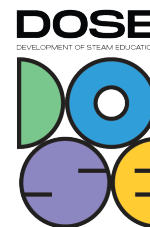
Non-formal education group "Arduino platform in robotics with Mblock". Topic "Wireless module HC-05".

1. Improve the electrical circuit by turning on the transistor and the wireless module.
2. Create an app to play scores in different ranges by managing ranges on your mobile phone.

Competencies:

- Learning to learn: self-evaluation of activities and evaluation of the performance of others; ability to move on to more successful operations.
- Social: collaborative learning.
- Communication: discussions, sharing the opinions, respect for others point of view; understanding and critical evaluation of the results of the research.
- Initiative and creativity: development of activity and creativity, sharing ideas with others.
- Personal: confidence, not afraid to make mistakes; building strength to achieve goals.

## TEMPLATE for BEST PRACTICE EXAMPLES - SOLVED TASK



11. Evaluation/Assessment guidelines:

Each teacher used formative assessment in his / her subject (additional points for the cumulative grade of the chapter)

12. Lessons learned:

- Students learned that in experiments with a vessel rather than a plane, sound waves resonate and wave interference occurs.
- Students adapted the wireless module to reduce the time spent on testing.
- Learned to apply knowledge of geometry to center objects.
- Learned to apply the knowledge of stochastics to analyze data and present them in tables and diagrams.
- The students used smart electronic circuits in this project.

13. Additional information/Links:

14. [https://www.canva.com/design/DAFAvxyo2go/WSE2\\_O8luk8bjdykTB\\_oVq/view?utm\\_content=DAFAvxyo2go&utm\\_campaign=designshare&utm\\_medium=link&utm\\_source=publicsharelink](https://www.canva.com/design/DAFAvxyo2go/WSE2_O8luk8bjdykTB_oVq/view?utm_content=DAFAvxyo2go&utm_campaign=designshare&utm_medium=link&utm_source=publicsharelink)

15. Contact person:

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